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AGE AND SIZE COMPOSITION OF THE MENHADEN CATCH ALONG THE ATLANTIC COAST OF THE UNITED STATES, 1958

WITH A BRIEF REVIEW OF THE COMMERCIAL FISHERY

by Fred C. June and William R. Nicholson

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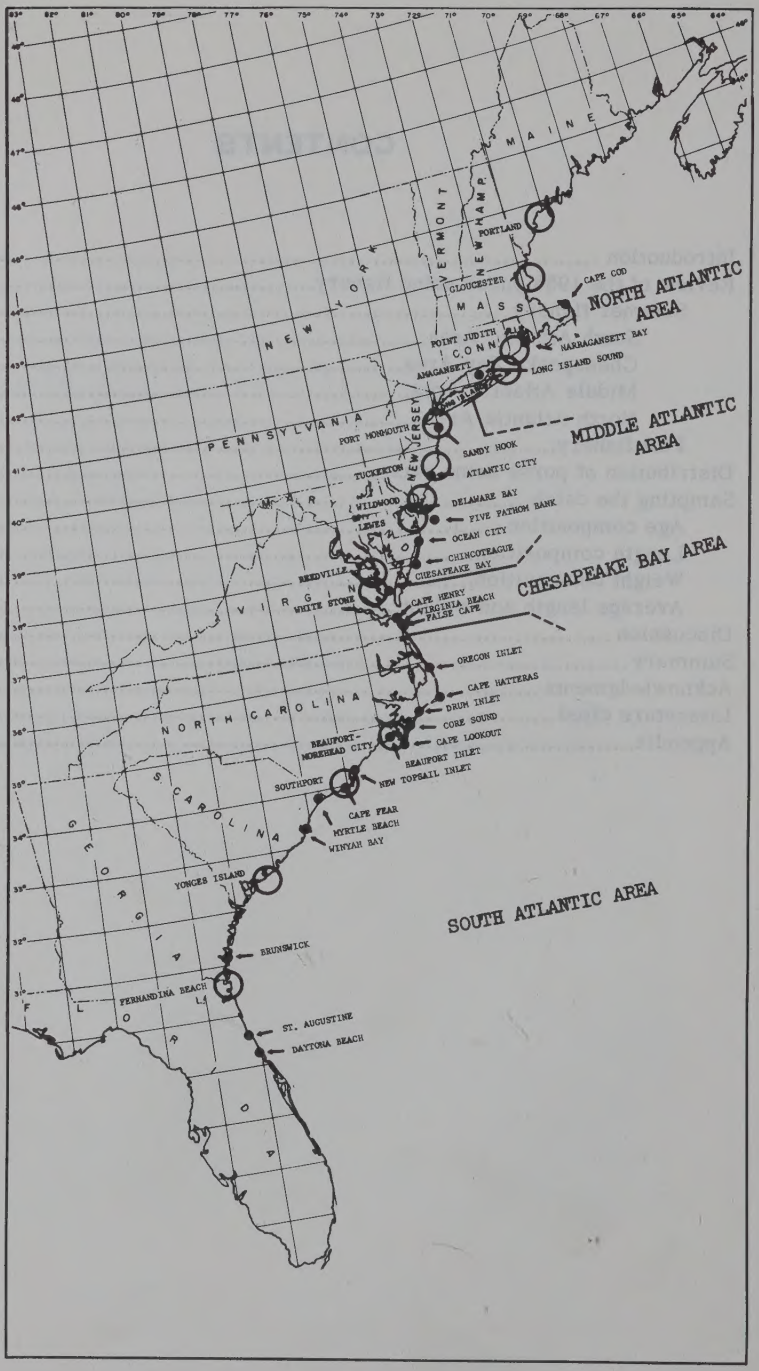

Figure 1.--Map showing areas used in summarizing Atlantic menhaden catch data,, locations of menhaden reduction plants (open circles) and location of places mentioned in the text (dots)

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ABSTRACT

The 1958 purse seine catch of Atlantic menhaden *(Brevoortia tyrannus)* was 540,000 tons, the smallest in the past 4 years; 462,000 tons were landed in the summer fishery and 78,000 tons, in the North Carolina fall fishery. Total fishing effort (24,545 sets) was less than that in the previous 3 years, and the greatest reduction occurred in the Middle and North Atlantic Areas. Average catch per set was 22 tons, compared with 20 tons in 1957, and 26 tons both in 1955 and 1956.

The 1956 year class (age-2 fish) accounted for 61 percent of the catch of nearly 2.8 billion fish, while the 1957 year class accounted for 31 percent. Age-1 fish dominated the summer catch in the South Atlantic Area (68 percent); age-2 fish dominated in the Chesapeake Bay (53 percent), Middle Atlantic (95 percent), and North Atlantic (53 percent) Areas; and age-O fish dominated the North Carolina fall fishery (38 percent). In most areas, the mean length of fish in the dominant 1956 year-class (age-2 fish) was less than that of the previous three year classes at the same age. Fish of older year classes were larger than those at identical ages in previous seasons.

INTRODUCTION

The purse seine fishery for Atlantic menhaden *(Brevoortia tyrannus)* is conducted from northern Flordia to central Maine and offshore to a depth of about 20 fathoms. Since 1950, the catch more than doubled and during the past 5 years averaged 650,000 tons annually. Marked seasonal and annual variations in abundance of fish have occurred in certain localities. Continuing seasons of low abundance in some localities recently have given rise to fear of depletion of the stock as a result of increased catches.

In 1955, the Bureau of Commercial Fisheries of the U. S. Fish and Wildlife Service undertook an investigation of the Atlantic menhaden fishery to determine whether fluctuations in abundance are related to fishing or result primarily from natural causes. The research program is an expansion of work begun in the Middle Atlantic States in 1952 and consists of continuing studies of the biology, structure, and dynamics of the species population. Most of the data for these studies are obtained from an annual catch-sampling program conducted throughout the geographical range and season of the purse seine fishery. Catches have been sampled each

TABLE 1.--Catch, total number of sets, and catch per set of the Atlantic menhaden purse seine fishery, 1955-58

Season and area	Catch in thousands of tons				Total number of sets[1]				Average catch per purse seine set (tons)			
	1955	1956	1957	[2] 1958	1955	1956	1957	1958	1955	1956	1957	1958
SUMMER FISHERY												
South Atlantic.....	48	73	38	47	2,526	3,042	2,375	3,615	19	24	16	13
Chesapeake Bay.....	153	89	118	149	5,667	6,357	8,428	8,765	27	14	14	17
Middle Atlantic....	328	402	342	232	13,120	14,358	15,545	8,286	25	28	22	28
North Atlantic.....	83	95	78	34	2,862	2,714	3,250	1,619	29	35	24	21
Subtotal.....	612	659	576	462	24,480	26,360	30,316	22,000	25	25	19	21
FALL FISHERY												
North Carolina.....	73	81	56	[3] 78	1,872	2,531	1,474	2,438	39	32	38	32
Total.....	685	740	632	540	26,346	28,462	31,600	24,545	26	26	20	22

[1] Slight discrepancies in number as given in previous reports and in subtotals and totals due to rounding the figures.

[2] Source: Edward A. Power Fishery Statistics of the United States, 1958. U.S. Fish and Wildlife Service, Statistical Digest 49, 424 p.

[3] The North Carolina fall fishery normally extends into January, therefore, catch total includes January 1959, but not January 1958. Seasonal breakdown of the catch obtained from U.S. Fish and Wildlife Service, C.F.S. Nos. 1991 and 1996.

season since 1955 at the various menhaden reduction plants shown in figure 1.

This, the fourth in a series of reports, summarizes data obtained from the catch-sampling program in 1958. Included are: (1) a review of the 1958 purse seine fishery; (2) measures of total catch, fishing effort, and catch per unit effort, including information on the geographical distribution of fishing effort; (3) summaries of data on the number, age, length, weight, and sex of fish in the catches; and (4) a discussion of results. As in previous reports, summary and discussion of the data are referred to four geographical areas (fig. 1) and two time periods--the "summer" fishery (May 5 to October 18)[1] and the "fall" fishery (October 28 to January 29, 1959).

[1] Several small purse seine catches of Atlantic menhaden were made off northern Florida in November and December, but mixed with other species and, therefore, excluded.

REVIEW OF THE 1958 PURSE SEINE FISHERY

The purse seine catch of Atlantic menhaden in 1958 was 540,000 tons (table 1),[2] of which 462,000 tons were taken in the summer fishery and 78,000 tons in the North Carolina fall fishery. A decrease in the catches in the Middle and North Atlantic Areas was largely responsible for the decline in total catch. In the Middle Atlantic Area, the catch was more than 100,000 tons below that of the previous season (32-percent decrease), and in the North Atlantic it was less than half that in 1957. The catches in the summer fishery in the South Atlantic and Chesapeake Bay Areas and the fall fishery in North Carolina were greater than those in the previous season.

[2] Additional 16,000 tons of Atlantic menhaden were caught by other gears. Pound nets accounted for 14,000 tons, and the remainder was caught by gill nets, haul seines, fyke nets, and otter trawls (Power, 1960). An estimated 65 percent of the 16,000-ton catch was reduced into fish meal, oil, and solubles; the remainder was used for bait.

The 24,545 purse seine sets[3] represented a decrease of 22 percent from that in 1957. The 22,000 sets in the summer fishery were 27 percent less than in 1957 and were the lowest in the past 4 seasons. The North Carolina fall fishery had 2,438 sets, which was 65 percent greater than in 1957. Average catch per set was 22 tons in 1958 compared to 20 tons in 1957 and 26 tons in both 1956 and 1955. Catch per set decreased in the South and North Atlantic Areas and in the North Carolina fall fishery, but increased in Chesapeake Bay and the Middle Atlantic Areas.

The purse seine fleet in 1958 was the smallest in 4 years. There were 116 vessels in the summer fishery and 61 in the North Carolina fall fishery.

Summer Fishery

South Atlantic Area.--The first catches in Florida waters were made off Fernandina Beach, Fla., on May 5. By the end of the following week, eight vessels were operating in northern Florida waters, and landings during the week of May 12-17, although small (631 tons), were the heaviest of the season. Through the remainder of May and early June, fishing by the Fernandina fleet extended from St. Augustine, Fla., to Brunswick, Ga., but schools were scarce and catches small. Four vessels terminated fishing and were transferred to the Gulf of Mexico fishery during the second week in June. The remainder of the fleet continued scouting from Daytona Beach, Fla., to Brunswick, but few schools were found. By the end of the month the entire fleet was tied up. There were no landings in July. In August, three Fernandina vessels were transferred to Yonges Island, S. C., but only one landing was made during the month by both the Fernandina and Yonges Island fleets. There were six landings in September and 12 in October. In mid-November, the Fernandina fleet intercepted migratory schools which were first sighted in the vicinity of Brunswick. Catches were small, however, and most of these were mixed with yellow fin menhaden *(Brevoortia smithi)* and Atlantic thread herring *(Opisthonema oglinum)*. Two landings on December 4 marked the end of the poorest season in more than a decade in this locality.

The first catch in North Carolina waters was taken in Core Sound on May 5 by a vessel from Beaufort. During the following week, five additional vessels began fishing in Core Sound and in the waters west of Cape Lookout, but catches were light. During the same week, schools appeared in abundance off Cape Fear, N. C., and a fleet of seven vessels began operating from Southport, N. C. During the third week in May, schools were numerous from the mouth of the Cape Fear River to New Topsail Inlet, and heavy landings were recorded for the Southport fleet and by four vessels that were added to the Beaufort fleet. Fishing continued in this locality through mid-June, with large catches recorded for all vessels. During the third week in June, however, schools became scarce, and the Southport fleet shifted to South Carolina waters where numerous schools were found from Winyah Bay to Myrtle Beach, S. C. Fishing improved off the South Carolina coast in early July, and landings reached a peak for the season during the week of July 21-26 when more than 4,000 tons were caught by the Southport fleet. During the following week few fish could be found, and only 13 landings were made by Southport vessels during August. Except for some scattered catches in the vicinity of Cape Fear during the first week in September and again during the third week in October, few schools were sighted in this locality during the remainder of the summer season. Following the disappearance of schools in the vicinity of Cape Fear in late June, four of the large vessels in the Beaufort fleet scouted as far northward as Cape Hatteras, N. C., but few catches were made. During this period, smaller vessels operated in Core Sound, and productive fishing continued there through September. Several large schools of migratory fish appeared off Cape Lookout in mid-September, and heavy landings were made as the vessels followed the schools southward to the vicinity of Cape Fear. This was the first time in the past 4 seasons that fishing was conducted in the

[3] Each set represents a single cast of the seine around a single school of fish in which the whole or part of the school was caught.

ocean waters off Beaufort during the later summer months. The last landings of the summer season were made at Southport on October 16 and at Beaufort on October 18.

The summer catch in the South Atlantic Area was 47,000 tons, distributed among the different months as follows: May, 18 percent; June, 29 percent; July, 32 percent; August, 4 percent; September, 13 percent; and October, 4 percent. Catch per set averaged 13 tons, the least in the past 4 summer seasons.

Chesapeake Bay Area.--First catches in Chesapeake Bay were on May 26[4] when two vessels each made a single set in the lower bay. On the following day, a fleet of 26 vessels began scouting in Virginia waters[5] of the bay, but few schools were seen. During the following several days, airplane pilots reported numerous schools outside the bay, between False Cape and Virginia Beach, Va., and some vessels made large catches in this locality. Fishing inside the bay, however, continued to be poor, because most of the schools of fish were small and scattered. Fish appeared in abundance inside the bay during the second week in June, and one additional vessel entered the fishery. Catches increased thereafter and reached an initial peak during the week of July 14-19 when approximately 14,000 tons were landed. During the following 3 weeks, schools remained abundant, and weekly landings averaged slightly more than 10,000 tons. Throughout this period, vessels ranged southward to Oregon Inlet, N. C., but the heaviest catches were made along the lower part of the Eastern Shore (Chesapeake Bay) and in the coastal waters lying between Cape Henry and False Cape. Stormy weather interrupted fishing during the last week in August, and catches were the smallest recorded since the first week of the season. Productive fishing resumed during the first week in September, and weekly landings during the month averaged approximately 11,000 tons. Fishing was concentrated off Virginia Beach and along the Eastern Shore of the lower part of the bay. Schools began disappearing from these waters the first week in October. Scarcity of schools and stormy weather were responsible for the smallest catches of the season during the week of October 5-11 (920 tons). Fishing improved during the following week, but stormy weather returned, and fishing was terminated on October 17.

The 1958 catch in the Chesapeake Bay Area was 149,000 tons, 26 percent greater than that of the preceding year and the highest since 1955 when 153,000 tons were caught. Monthly landings were distributed as follows: May, 1 percent; June, 15 percent; July, 23 percent; August, 33 percent; September, 26 percent; and October, 2 percent. Catch per set averaged 17 tons, the highest since 1955 (27 tons).

Middle Atlantic Area.--The first catch of the season in the Middle Atlantic Area was made by a single vessel on May 30 off Delaware Bay. On the following day, three additional vessels began fishing in the same locality, however, few schools were seen and only a few small catches made. High winds prevented fishing during the early part of the first week in June, but by the end of the week the weather improved and 30 additional vessels had entered the fishery. Airplane pilots searched the entire area during this period, but only a few schools were seen in the vicinity of Sandy Hook, N. J. During the following week, schools appeared in the coastal waters north of Ocean City, Md., however, catches by a fleet of 43 vessels continued to be poor. Weekly landings averaged only 4,000 tons during the first 3 weeks of June. In the final week of the month, schools became more abundant in most localities, and landings for the week increased to 14,000 tons. Landings exceeded 17,000 tons during the first week in July, but dropped to less than 6,000 tons during the following week when schools became scarce along the entire Middle Atlantic coast. During the last 3 weeks in July, vessels ranged farther offshore in their search for fish than in any previous season. Schools reappeared in abundance in the vicinity of Delaware Bay in early August. Subsequently, fishing improved in waters south of Atlantic City, N. J., and the heaviest catches of the season were being taken off

[4] Virginia law prohibits purse seining in Virginia waters prior to the last Monday in May.

[5] Purse seine fishing is prohibited in Maryland.

Chincoteague, Va., in Delaware Bay, and off Cape May, N. J., when hurricane "Daisy" interrupted fishing during the last week in August. Following the hurricane, fishing was productive in the central part of the area through the third week in September. In the following week, schools suddenly vanished from most localities, and relatively few were seen thereafter. From September 26 to the close of the season on October 10, there were only 98 vessel landings, or an average of about 2 landings per vessel. For the first time in more than 2 decades, large schools of older fish failed to congregate along the southern Long Island coast in late September and October. The last catches of the season were made on scattered schools off the western end of Long Island.

The catch in the area amounted to 232,000 tons, the smallest since 1952 when 184,000 tons were landed. In previous seasons, the greatest share of the annual catch was taken in August; in 1958, the peak production occurred in September. Monthly catches were distributed as follows: May, 1 percent; June, 12 percent; July, 27 percent; August, 28 percent; September, 32 percent; and October, 1 percent. Catch per set averaged 28 tons compared to 22 tons in the previous season.

North Atlantic Area.--The first catch of the season in the North Atlantic Area was made in Narragansett Bay by a Point Judith, R. I., vessel on June 5. During the ensuing week, a second vessel from Point Judith began fishing in Narragansett Bay, and a fleet of 10 vessels from Amagansett, N. Y., began operating along the southern coast of Long Island. Schools were scarce in all localities, and landings through the month were small and sporadic. Amagansett vessels scouted for fish from western Long Island Sound to Cape Cod, and in early July they were joined by six vessels from Gloucester, Mass. The combined fleets found only a few schools. There were no landings by the Gloucester fleet until July 9, and only 12 landings were recorded at that port during the month. Schools remained scarce throughout the area during most of August. There were no landings at Gloucester after August 20, and later in the month, several of the Amagansett vessels joined the fleet fishing out of Lewes, Del. During the first week in September, schools of large, migrating fish appeared in Long Island Sound and off the eastern end of Long Island, and the heaviest catches of the season were taken by the Amagansett fleet during a 2-week period beginning September 15. Stormy weather and the sporadic appearance of the fish accounted for a small number of landings during the first 2 weeks in October. The last catches in this locality were taken on October 14, while several additional catches were made in Narragansett Bay by Point Judith vessels during the following week.

A total catch of 34,000 tons was less than half that of the previous season. Ten percent of the catch was taken in June, 22 percent in July, 28 percent in August, 27 percent in September, and 13 percent in October. Catch per unit of effort averaged 21 tons, the smallest in the past 4 seasons.

Fall Fishery

The North Carolina fall fishery began earlier and ended later than in the previous 3 seasons. The first catches were made on an early run of small fish which appeared off Beaufort Inlet on October 28. During the following week, part of the fleet intercepted several schools of large fish which appeared off Ocracoke Inlet. Several additional schools of large fish subsequently appeared in this locality, and during the 2-week period, November 9-22, approximately 19,000 tons were caught as the fish moved slowly southward along the coast. Stormy weather interrupted fishing during the following week, and landings amounted to only 275 tons. Fishing resumed on December 1, and landings for the week totaled 28,900 tons, the heaviest of the season. During the ensuing 2 weeks, the fleet operated between Drum and Beaufort Inlets, and weekly landings averaged over 10,000 tons. Most of the vessels stopped fishing by December 22. On January 7, five vessels resumed fishing in the vicinity of Cape Lookout, and except for 175 tons of large fish, catches through the remainder of the season (January 27) consisted of young-of-the-year, or age-0 fish. The catch for the season totaled 78,000 tons, of which 26 percent was landed in November, 68 percent in December, and 6 percent in January. Average catch per set of 32 tons was slightly less than that in the previous year.

DISTRIBUTION OF PURSE SEINE SETS

The distribution of purse seine sets is shown in figures 2, 3, and 4 where the calculated relative numbers of purse seine sets were plotted by 10-minute unit areas. The data were compiled from logbooks of daily fishing activities furnished by the vessel captains or pilots. Complete logbook data were obtained for 59 percent of the total landings. Compared with the previous 3 seasons, the following differences were most apparent: (1) In the South Atlantic Area, fewer sets were made, and there was no fishing from central Georgia to central South Carolina; a greater amount of effort was expended between lat. 33° and 34° N. and in the vicinity of lat. 36° N.; (2) in the Middle Atlantic Area, there was greater amount of fishing beyond the 20-fathom contour; and (3) in the North Atlantic Area, there was a marked reduction in fishing north of Cape Cod (less than 50 sets were made in those waters in 1958).

SAMPLING THE CATCH

The 1958 catch-sampling program was conducted in the same manner as in previous seasons, except that no samples were obtained at Portland, Maine (only four landings were made at that port in 1958). The number of samples taken at other plant locations is given in table 2. One sample was obtained for every 660 tons of fish caught in the summer fishery and for every 857 tons caught in the North Carolina fall fishery.

TABLE 2.--Number of samples taken from purse seine catches of Atlantic menhaden, 1958

Season and locality	Number of samples
SUMMER FISHERY	
Fernandina Beach, Fla.	21
Southport, N.C.	34
Beaufort, N.C.	70
Reedville, Va.	156
Lewes, Del.	93
Wildwood, N.J.	104
Port Monmouth, N.J.	116
Amagansett, N.Y.	101
Gloucester, Mass.	5
Subtotal	700
FALL FISHERY	
Beaufort-Morehead City, N.C.	91
Total	791

In 1958, about one-third of the vessels in the fleet adopted an electrical shocking device to aid in pumping the catch from the net into the hold. The fish in the net are attracted to and immobilized by an electrode fastened to the end of the suction hose, thus facilitating the pumping of the fish (Kreutzer, 1959). Since it is known that larger fish in the net are affected more strongly by the electrical current than smaller fish and thus would be pumped into the hold first, it is possible that the catch would be stratified by size. To determine if stratification occurred, samples occasionally were taken from different levels in the hold during pumping operations and the length-frequency distributions of the fish compared. Results showed that variation was no greater than would be expected in sampling a homogenous population; hence, it was concluded that the use of electrical shockers did not cause stratification of fish in the hold. Results of four such tests are given in table 3.

Age Composition

The most outstanding features of the age composition in 1958 were the dominance of the 1956 year class (age-2 fish) and the decreased proportion of older year classes (table 4). Of an estimated 2.8 billion fish in the catch, the 1956 year class accounted for 1.7 billion, or 61 percent. This was the largest contribution of age-2 fish in the past 4 seasons. The 1957 year class (age-1 fish) accounted for an additional 31 percent with an estimated 0.9 billion fish. This was only about half the number contributed at the same age by the 1955 and 1956 year classes. The newly recruited 1958 year class (age-0 fish) furnished an additional 0.1 billion fish, or about 4 percent of the total. Older year classes (fish of ages 3-10) furnished slightly more than 0.1 billion fish, compared to 0.3 billion in 1957 and 0.6 billion in 1955 and 1956.

The percentage age composition of the summer catches in the different areas and of the fall catch off North Carolina is shown in figure 5 and listed in table 5. The calculated

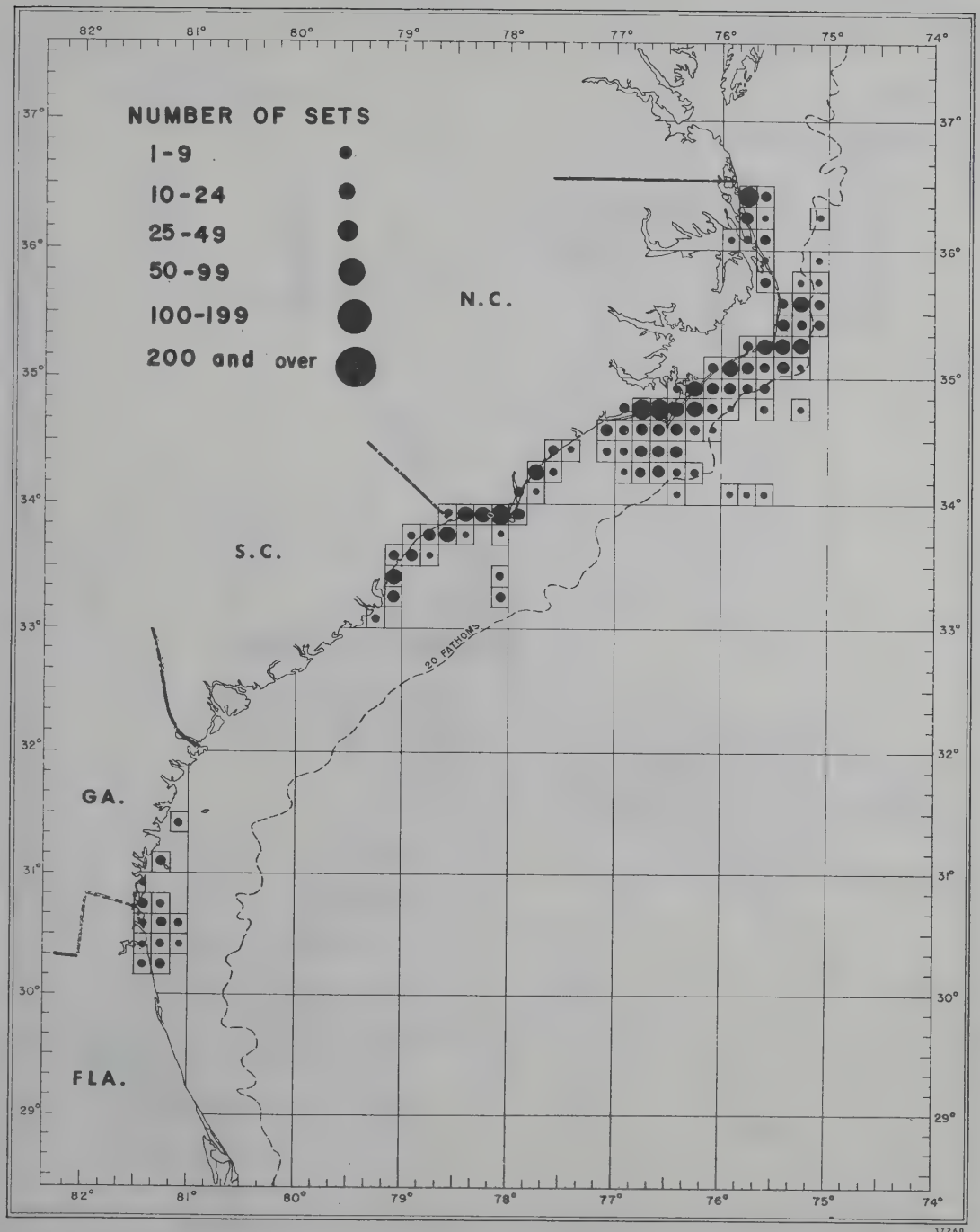

Figure 2.--Distribution of purse seine sets for Atlantic menhaden in the South Atlantic Area, 1958.

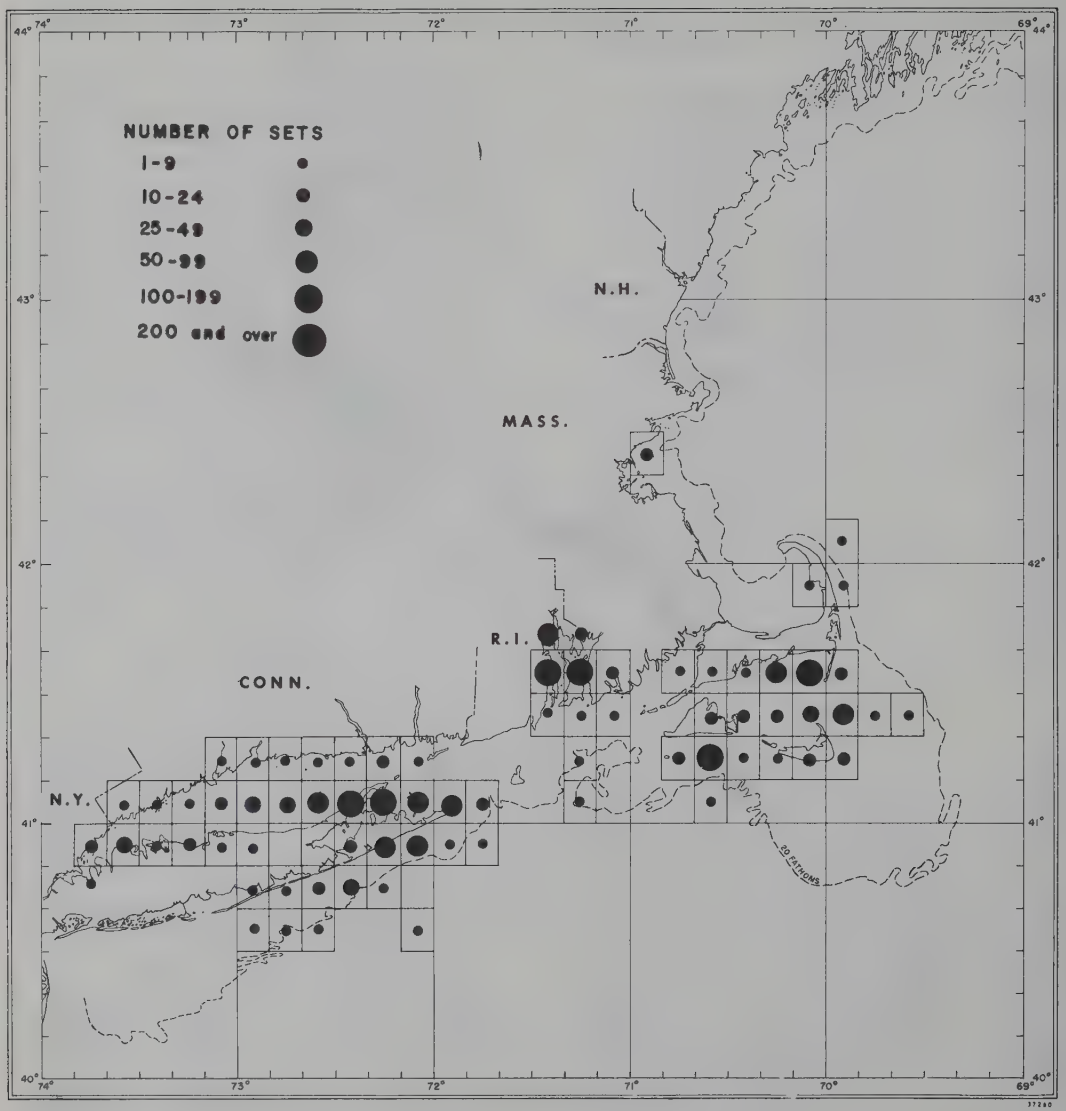

Figure 3.--Distribution of purse seine sets for Atlantic menhaden in the Chesapeake Bay and Middle Atlantic Areas. 1958.

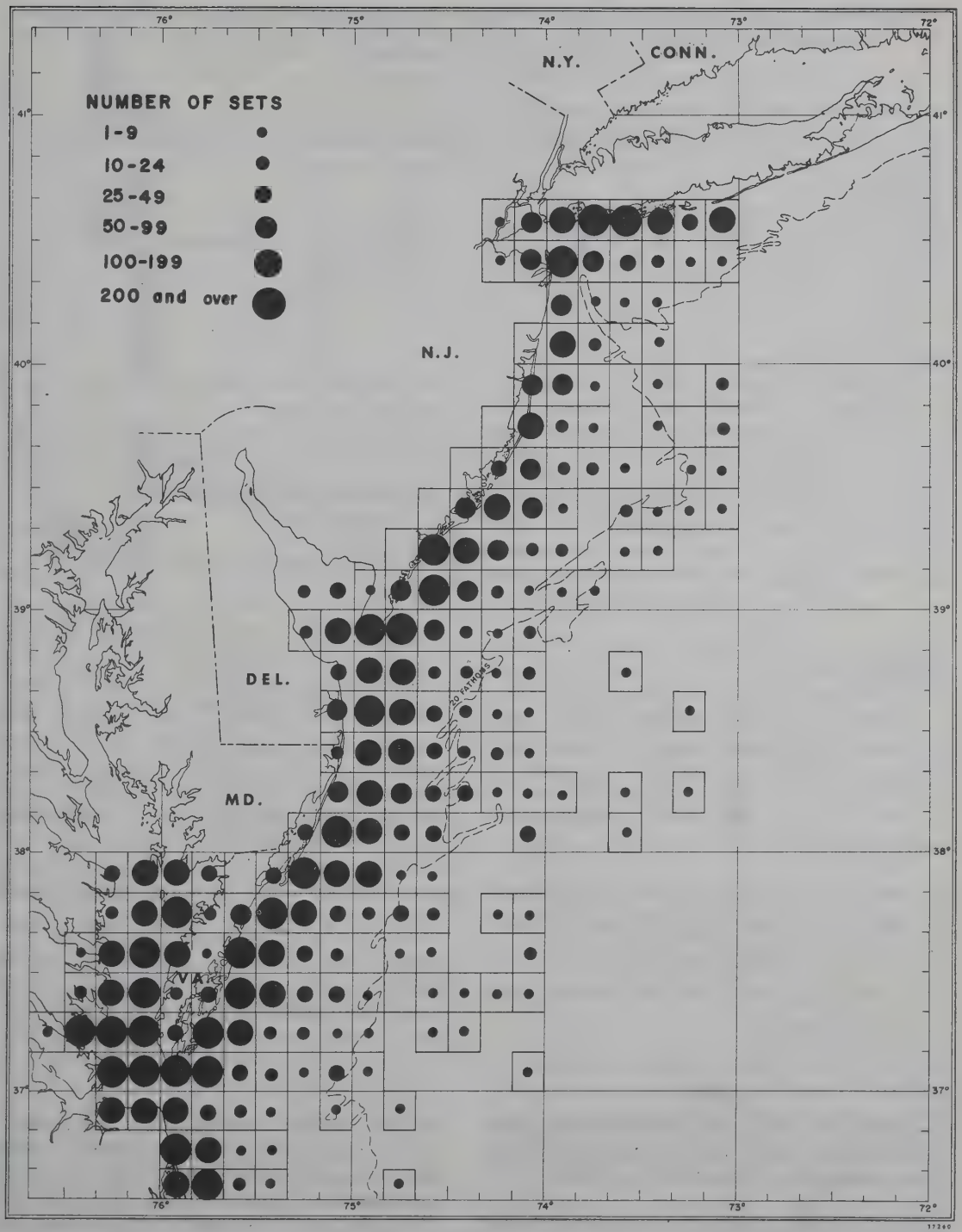

Figure 4.--Distribution of purse seine sets for Atlantic menhaden in the North Atlantic Area, 1958.

TABLE 3.--Length-frequency distributions and mean lengths of Atlantic menhaden in samples taken from the bottom middle, and top layers of the catch in the hold from four purse seine sets in which the fish were electrically shocked prior to being pumped into the hold, 1958

Fork Length	Set No. 1		Set No. 2			Set No. 3		Set No. 4		
	Bottom	Top	Bottom	Middle	Top	Bottom	Top	Bottom	Middle	Top
205-209.....	1	3	-	-	1	-	-	-	-	-
210-214.....	3	5	-	1	4	-	-	-	-	-
215-219.....	16	16	8	12	11	2	2	-	-	-
220-224.....	36	26	25	27	35	9	6	-	-	-
225-229.....	23	27	32	33	29	17	22	1	-	-
230-234.....	13	15	22	21	10	33	35	6	2	6
235-239.....	7	4	5	3	7	23	25	17	14	19
240-244.....	1	4	2	3	2	13	9	28	23	30
245-249.....	-	-	-	-	-	2	1	28	16	26
250-254.....	-	-	-	-	-	-	-	15	10	14
255-259.....	-	-	-	-	-	-	-	4	1	5
260-264.....	-	-	-	-	-	-	-	1	2	-
265-269.....	-	-	-	-	1	-	-	-	-	-
Total.....	100	100	94	100	100	100	100	100	68	100
Mean.....	225.0	225.0	227.3	226.6	225.8	233.4	232.8	244.6	244.6	244.4

TABLE 4.--Age composition (in percent) and calculated number of Atlantic menhaden (in millions) at each age in purse seine catches, 1955-58.

[Most numerous age group underscored]

Year	Age group									
	0	1	2	3	4	5	6	7	8-10	Total
Age Composition (percent)										
1955.....	24.71	20.68	34.21	8.73	10.01	1.23	0.35	0.06	0.02	100.00
1956.....	1.00	57.16	25.97	9.61	1.26	4.18	0.67	0.12	0.02	99.99
1957.....	8.46	41.97	41.00	3.26	2.52	1.40	1.22	0.12	0.04	99.99
1958.....	3.81	30.85	60.93	2.72	0.62	0.56	0.32	0.17	+ [1]	99.98
Number of fish (millions)										
1955.....	761.01	636.86	1,053.47	268.87	308.21	37.95	10.75	1.88	0.59	3,079.59
1956.....	36.37	2,072.95	941.71	348.42	45.60	151.49	24.38	4.47	0.88	3,626.27
1957.....	300.77	1,491.13	1,456.63	115.96	89.72	49.66	43.43	4.34	1.27	3,552.91
1958.....	106.06	858.29	1,694.99	75.75	17.31	15.61	9.01	4.69	0.10	2,781.81

[1] + = <0.01 percent

numbers of fish in the different age groups are given in table 6. Data for previous seasons are included for comparative purposes.

In the South Atlantic Area, the distribution in ages in the summer fishery was essentially the same as in the previous 3 seasons, except for the greater contributions of fish of ages 2 and 3. Age-1 fish (1957 year class) accounted for more than two-thirds of the catch with a contribution of approximately 300 million fish. This was only one-quarter the number furnished by the 1955 year class at age 1 in 1956, but represented the second largest contribution

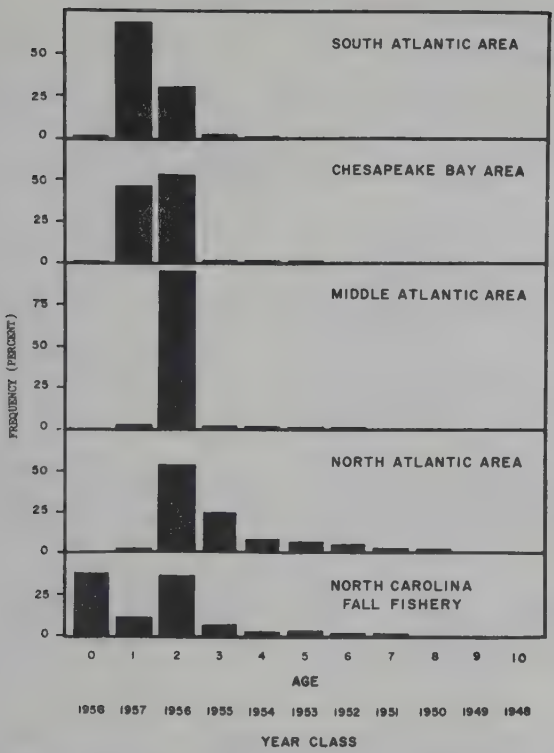

Figure 5.- Age composition of purse seine catches of Atlantic menhaden, 1958.

by a single year class at age 1 during the past 4 summer seasons. For the second successive season, fish of the 1956 year class (age 2) continued to be numerous in the catch, and for the third consecutive season, the 1955 year class (age 3) also made a substantial showing. No fish beyond age 4 occurred in the samples.

In Chesapeake Bay, age-2 fish (1956 year class) accounted for more than half the catch with a contribution of more than 500 million fish. This was the largest contribution of age-2 fish during the past 4 seasons and the second season in succession that the 1956 year class provided the bulk of the catch. In 1957, at age 1, it furnished more than four-fifths of the bay catch, and its contribution was nearly double that of either of the previous two year classes at the same age. Age-1 fish (1957 year class) ranked second in importance and also furnished approximately 500 million fish (46 percent of the catch). The 1955 year class (age 3) also made a notable contribution to the catch.

The catch in the Middle Atlantic Area was dominated by age-2 fish (1956 year class) which accounted for 95 percent of the total. Age-1 fish (1957 year class) furnished only 2.5 percent of the catch, and fish of age 3 and older ages were represented in considerably fewer numbers in 1958. The number of fish caught was less than 1 billion (894 million) for the first time since 1952.

The catch in the North Atlantic Area was dominated by age-2 fish (1956 year class), but they were only about half as numerous as the 1955 year class at age 2 in 1957. For the second successive season, age-1 fish also appeared in the catches; however, they accounted for less than 1 percent of the total. Compared with the previous season, there was a greater proportion of age-3 fish in the catch, but there was a noticeable reduction in the contributions by all older age groups.

In the North Carolina fall fishery, age-0 fish (1958 year class) were most numerous (38 percent of the catch), followed by age-2 fish (36 percent). This was the greatest contribution to the catch of age-2 fish in the past 4 seasons. Contributions of all other age groups, except age 7 (1951 year class), were below average.

Length Composition

Length-frequency distributions of fish in samples from the summer purse seine catches in each area and from the fall catch off North Carolina are shown in figure 6 and listed in appendix tables 1-5.

In the South Atlantic Area, fish ranged from 90 to 250 mm. in fork length, and two prominent peaks were evident in the length-frequency curve. The length distribution of age-1 fish showed a primary peak at 172 mm., while that of age-2 fish had a distinct mode at 192 mm. The spread in lengths was greater for age-1 fish than for age-2 fish, and beyond 150 mm., there was a complete overlap in the length distributions of the two age groups.

TABLE 5.--Age composition (in percent) of purse seine catches of Atlantic menhaden, by area and season, 1955-58

[Most numerous age group underscored]

Season, area, and year	Age group								
	0	1	2	3	4	5	6	7	8-10
SUMMER FISHERY									
South Atlantic:									
1955	1.66	65.22	27.02	3.32	2.77	--	--	--	--
1956	--	98.98	0.94	0.05	0.02	--	--	--	--
1957	3.65	32.47	63.76	0.12	--	--	--	--	--
1958	0.32	68.44	29.40	1.79	0.06	--	--	--	--
Chesapeake Bay:									
1955	1.63	44.77	51.30	1.54	0.69	0.06	--	--	--
1956	--	90.91	9.02	0.07	--	--	--	--	--
1957	0.25	85.22	14.25	0.26	0.02	0.01	--	--	--
1958	0.04	46.32	53.01	0.50	0.08	0.04	--	--	--
Middle Atlantic:									
1955	--	1.81	55.79	23.18	17.43	1.40	0.26	0.10	0.01
1956	--	14.78	63.96	18.08	1.44	1.41	0.26	0.06	0.01
1957	--	22.24	68.51	4.26	2.62	1.26	1.02	0.03	0.05
1958	--	2.54	95.08	2.21	0.12	0.03	0.02	--	--
North Atlantic:									
1955	--	--	0.25	13.94	67.55	12.84	4.65	0.54	0.22
1956	--	--	6.41	36.35	8.22	40.96	6.42	1.29	0.36
1957	--	0.91	45.00	18.79	16.06	8.59	8.95	1.45	0.24
1958	--	0.16	52.58	24.47	8.43	6.75	5.13	2.36	0.11
FALL FISHERY									
North Carolina:									
1955	87.19	3.61	6.00	0.86	1.96	0.32	0.04	--	0.01
1956	16.12	26.78	11.95	16.61	4.15	20.61	3.31	0.46	--
1957	74.20	3.24	6.08	4.07	5.40	3.84	2.89	0.25	0.02
1958	38.07	10.73	35.86	7.18	2.63	3.14	1.48	0.91	--

In the Chesapeake Bay Area, the length-frequency curve was negatively skewed, ranged from 110 to 315 mm., and showed a single, dominant mode at 212 mm. The length curve for age-1 fish had a mode at 198 mm. and that for age-2 fish, at 212 mm. As in the South Atlantic Area, the range in lengths of age-1 fish was nearly double that of age-2 fish with considerable overlap between the two age groups.

Fork lengths of fish in catch samples from the Middle Atlantic Area ranged from 155 to 340 mm. The length curve was unimodal (actually the mode appeared in two adjacent length classes), slightly asymmetical, and based almost entirely on age-2 fish.

The length curve for the North Atlantic Area ranged from 200 to 365 mm. and consisted of two distinct groups. The first was comprised primarily of age-2 fish and had a prominent peak at approximately 258 mm. The second was comprised of fish of age 3 and older ages, with a peak at approximately 322 mm. Although age-2 fish were almost completely separated from age-4 and older fish, age-3 fish were virtually indistinguishable because of the great spread in their lengths.

Lengths of fish in the North Carolina fall fishery ranged from 65 to 355 mm. Age-0 fish were almost completely separated from those of all other ages and consisted of two size groups. The smaller group ranged from 65 to 95 mm., with a peak at 82 mm., and the larger group ranged to approximately 160 mm., with a peak at 118 mm. Age-1 fish ranged from 165 to 280 mm., with a prominent peak at 192 mm. The curve representing age-2 fish was asymmetrical and skewed to the left. Lengths of this age group ranged from 185 to 315 mm. The largest length group was comprised mostly of age-4 and older fish, with age-3 fish completely obscured.

TABLE 6.--Calculated number of Atlantic menhaden (millions) by age groups in purse seine catches, by area and season, 1955-58

[Most numerous age group underscored]

Season, area and year	Age Group									Total
	0	1	2	3	4	5	6	7	8-10	
SUMMER FISHERY										
South Atlantic:										
1955	6.51	255.20	105.74	13.01	10.83	--	--	--	--	391.29
1956	--	1,147.88	10.91	0.63	0.23	0.02	--	--	--	1,159.67
1957	13.27	117.91	231.56	0.42	--	--	--	--	--	363.16
1958	1.47	315.20	135.39	8.25	0.26	--	--	--	--	460.57
Chesapeake Bay:										
1955	12.18	334.24	382.92	11.52	5.17	0.43	--	--	--	746.46
1956	--	674.37	66.90	0.49	--	--	--	--	--	741.76
1957	3.12	1,056.16	176.58	3.22	0.22	0.08	--	--	--	1,239.38
1958	0.48	490.88	561.76	5.25	0.90	0.39	--	--	--	1,059.66
Middle Atlantic:										
1955	--	16.66	513.31	312.26	160.40	12.90	2.34	0.96	0.12	1,018.95
1956	--	190.28	823.35	232.82	18.60	18.19	3.31	0.71	0.13	1,287.39
1957	--	302.78	932.53	58.05	35.72	17.15	13.92	0.40	0.69	1,361.24
1958	--	22.73	850.63	19.75	1.07	0.31	0.17	--	--	894.66
North Atlantic:										
1955	--	--	0.42	23.76	115.10	21.88	7.93	0.92	0.37	170.38
1956	--	--	13.58	77.00	17.41	86.78	13.59	2.73	0.75	211.84
1957	--	1.87	92.66	38.68	33.07	17.69	18.44	2.99	0.50	205.90
1958	--	0.14	49.13	22.87	7.88	6.31	4.80	2.21	0.10	93.44
FALL FISHERY										
North Carolina:										
1955	742.32	30.76	51.08	7.32	16.71	2.74	0.39	--	0.10	851.42
1956	36.37	60.42	26.97	37.48	9.36	46.50	7.48	1.03	--	225.61
1957	284.39	12.41	23.30	15.60	20.72	14.74	11.07	0.95	0.08	383.26
1958	104.11	29.34	98.08	19.63	7.20	8.60	4.04	2.48	--	273.48

All of the main features of the length-frequency curves noted by June and Reintjes (1959 and 1960) for previous years and stated by June (1961) were evident in the 1958 data; however, there was a noticeable decline in the proportion of large fish. The size difference between sexes also persisted in 1958 (fig. 7), and a distinct shift in the sex ratios had some bearing on length composition in several areas (table 7). For example, in the South Atlantic Area, the ratio of females to males changed from 0.98 in 1957 to 0.89 in 1958; in Chesapeake Bay, the ratio decreased from 1.38[6] to 0.94; in the Middle Atlantic Area, the sex ratio remained essentially unchanged (1.03 in 1957 and 1.02 in 1958); in the North Atlantic Area, it decreased from 1.12 in 1957 to 0.99 in 1958 and in the North Carolina fall fishery, from 1.18 to 0.95. The increase in the number of males thus resulted in a slight reduction in the size of fish contributing to the catches in all but the Middle Atlantic Area in 1958. No further explanation for the unequal representation of sexes in the catch can be added to that offered by June (1961).

[6] June (1961) remarked that the sex-ratio data for Chesapeake Bay in 1957 may have been biased in favor of females because of the difficulty of recognizing testes of immature males which were partially decomposed.

Weight Composition

The weight-frequency distributions of fish in samples from the purse seine catches are listed in appendix tables 6-10. The weight-frequency curves, in general, reflected the dominant age group(s) which comprised the bulk of the catch in the different areas, but notable discrepancies are evident (fig. 8).

In the South Atlantic Area, the asymmetric curve reflected the overlapping weight distributions of age-1 fish (58 percent of the catch

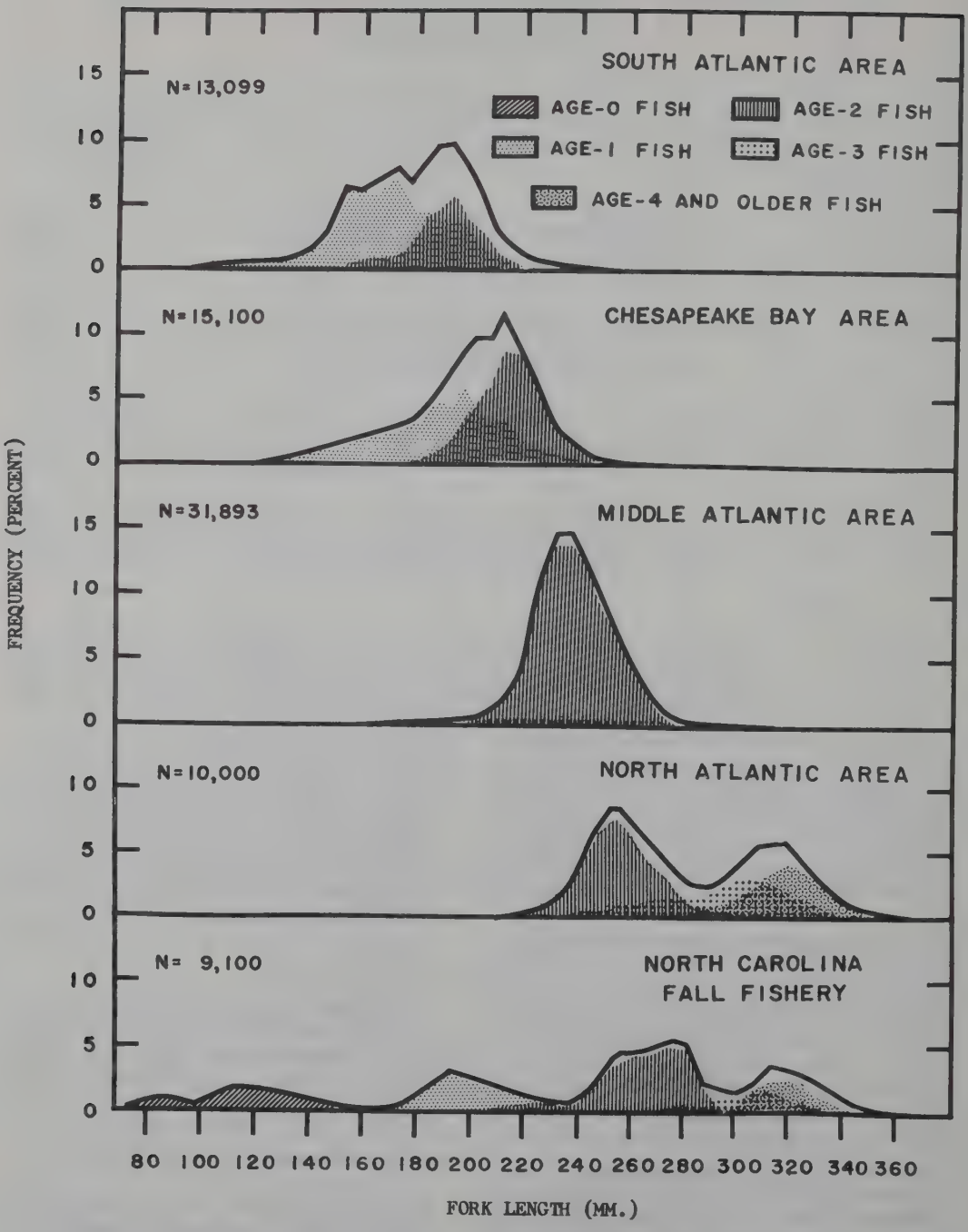

Figure 6.--Length composition of samples from purse seine catches of Atlantic menhaden, 1958.

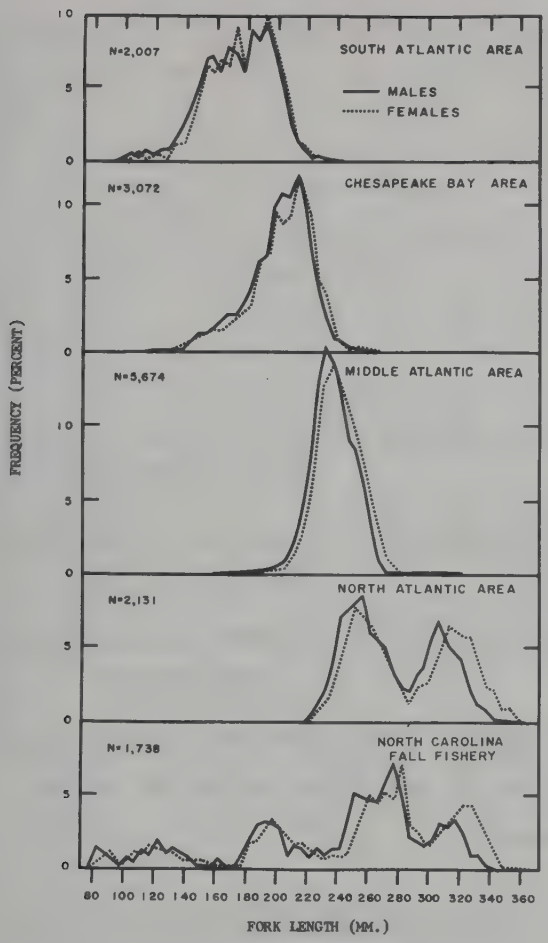

Figure 7.--Length frequencies of males and females in samples from purse seine catches of Atlantic menhaden, 1958.

TABLE 7.--Sex ratios in samples from purse seine catches of Atlantic menhaden, by area, 1958

Season and area	Females	Males	Ratio of females to males
SUMMER FISHERY	*Number*	*Number*	
South Atlantic.....	944	1,063	.89
Chesapeake Bay.....	1,490	1,582	.94
Middle Atlantic.....	2,864	2,810	1.02
North Atlantic.....	1,060	1,071	.99
FALL FISHERY			
North Carolina.....	854	904	.94

by weight), with a peak at 65 g., and of age-2 fish, with a less distinct peak at 105 g.

In Chesapeake Bay, the weight frequencies of age-1 fish (39 percent of the catch by weight) and age-2 fish (60 percent of the catch by weight) were indistinguishable and represented by a dominant mode at 135 g.

In the Middle Atlantic Area, where age-2 fish constituted 97 percent of the catch by weight, a dominant mode appeared at 225 g. The positive skewness of the curve resulted primarily from the presence in the catch of fish older than age 2.

In the North Atlantic Area, the weight of age-2 fish (approximately 40 percent of the catch by weight) were distinguishable up to about 400 g., and an ill-defined peak may be seen at 305 g. in figure 8. Over the remainder of the range, there was no concentration of fish in any one weight class.

In the North Carolina fall fishery, four distinct size groups were evident. The first group, ranging up to 80 g. in weight, with a mode at 15 g., consisted entirely of age-0 fish which appeared for the first time in numbers in the 1958 catch. The second weight group, from 80 to approximately 210 g., was comprised primarily of age-1 fish. Except for the shift to the right (as a result of the summer's growth), the remaining portion of the curve resembled that for the North Atlantic summer catch, with age-2 fish (over 50 percent of the fall catch by weight) accounting for the major portion of the size group from approximately 210 to 500 g.

Average Length and Weight

Mean lengths and weights of fish, by age, sex, and area, in 1958, are listed in appendix tables 11-15 and by age, area, and season, 1955-58, in tables 8 and 9. With the exception of fish caught in the Chesapeake Bay Area, the mean lengths and weights in 1958 were less than those in 1957 (last column in tables 8 and 9). The greatest decreases occurred in the North Atlantic Area and the North Carolina

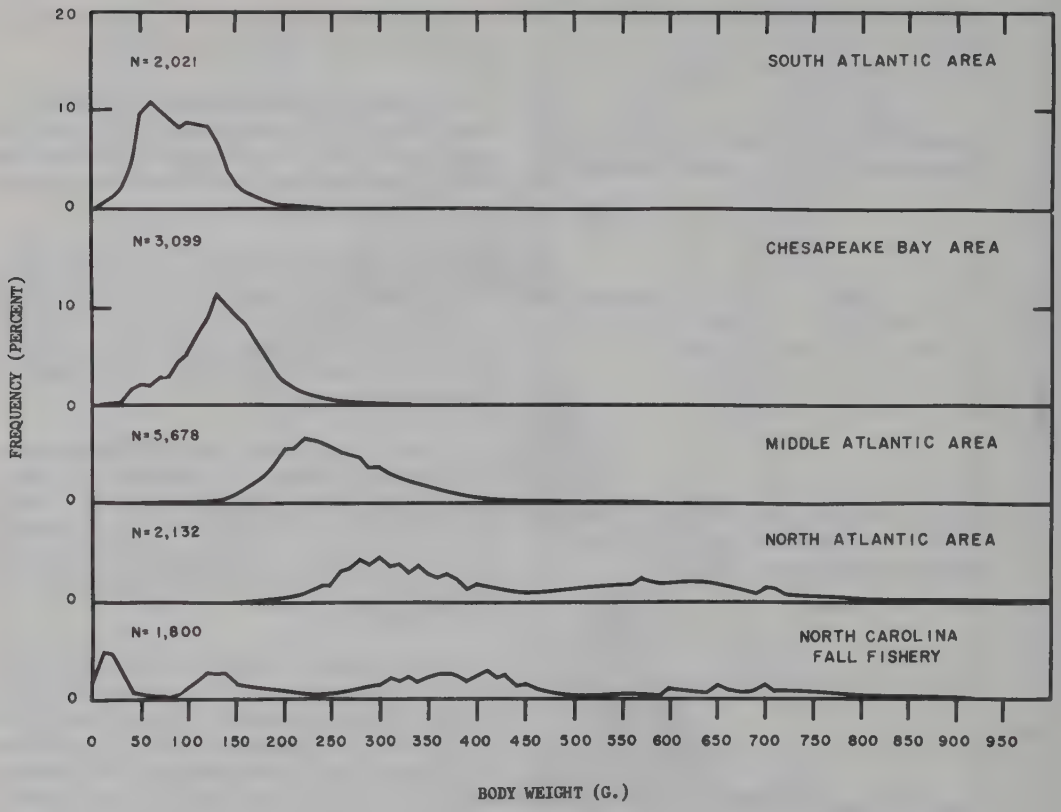

Figure 8.--Weight frequency of samples from purse seine catches of Atlantic manhaden, 1958

fall fishery. Compared with the previous season, mean lengths and weights of certain age groups increased, while others decreased. In all areas, age-1 fish (1957 year class) were longer than those in the previous two year classes and, except for those in the Middle and North Atlantic Areas, were heavier. Mean lengths of age-2 fish in the summer fishery, on the other hand, were the shortest in the past four seasons, but mean weights were variable. Mean lengths and weights of older age groups also were more variable in 1958, but generally greater than those in previous seasons.

DISCUSSION

Before discussing the 1958 fishery, it is pertinent here to examine several hypotheses regarding the migrations and population structure of Atlantic menhaden developed from the pattern of age and size distribution during successive fishing seasons. These are: (1) Atlantic menhaden undertake an annual, north-south, cyclic migration; (2) there are at least two recognizable subpopulations, and during the summer, one is distributed from Cape Hatteras, N. C., northward and the other, south of that location; (3) year classes which are represented in the summer fishery north of Cape Hatteras are represented in the same proportion in the North Carolina fall fishery; and (4) the same length-age groups return in spring to those localities occupied during the previous autumn.

That the fish migrate seasonally is generally accepted, but whether the stocks in all areas

TABLE 8.--Mean fork length (in millimeters) of Atlantic mehaden at each age in samples from purse seine catches, by area and season, 1955-58

[Most numerous age group underscored]

Season, area and year	Age group											Weighted mean
	0	1	2	3	4	5	6	7	8	9	10	
SUMMER FISHERY												
South Atlantic:												
1955	128	168	195	208	212	--	--	--	--	--	--	177
1956	--	159	198	214	224	234	--	--	--	--	--	160
1957	129	167	190	218	--	--	--	--	--	--	--	180
1958	132	168	190	202	211	--	--	--	--	--	--	175
Chesapeake Bay:												
1955	152	199	236	244	251	242	--	--	--	--	--	219
1956	--	187	222	293	--	--	--	--	--	--	--	191
1957	158	180	221	223	267	252	--	--	--	--	--	186
1958	118	189	213	230	307	311	--	--	--	--	--	202
Middle Atlantic:												
1955	--	228	259	279	290	300	314	333	310	--	--	274
1956	--	221	252	286	302	311	317	321	332	--	--	264
1957	--	200	240	279	309	314	317	306	324	327	--	240
1958	--	214	239	253	300	313	323	--	--	--	--	239
North Atlantic:												
1955	--	--	277	287	301	316	323	330	336	347	344	303
1956	--	--	277	290	307	315	322	328	336	340	--	306
1957	--	218	266	292	309	317	321	322	321	332	--	295
1958	--	223	255	292	310	321	328	330	344	--	--	281
FALL FISHERY												
North Carolina:												
1955	123	209	259	282	304	317	321	--	338	--	--	215
1956	118	182	262	298	308	312	318	325	--	--	--	253
1957	129	181	285	302	314	319	322	323	334	--	--	269
1958	116	202	264	304	315	324	328	330	--	--	--	244

participate in the migration has been a matter of conjecture. The fish congregate in large schools, just prior to their disappearance from the summer fishing grounds. Such large schools, sometimes a mile or more in diameter, appear off the coast of North Carolina in November, usually in the vicinity of Cape Hatteras, and disappear off Cape Fear in December.

Comparison of the length frequencies of the major year classes contributing to the catch just prior to the time the schools disappeared from the summer fishing grounds in October (data for the South Atlantic Area include late September, since few fish were caught in October in any year) with those of the same year classes which occurred in the North Carolina fall fishery in November and December, reveals a striking pattern (upper five panels of fig. 9 and table 10). In every year, the lengths of the major year classes in the end-of-season catches in the areas north of Cape Hatteras were represented in the North Carolina fall fishery. Larger fish in the younger age groups were not represented in the South Atlantic Area prior to the fall fishery. In only one year (1956) were fish in the October catches in the South Atlantic Area identifiable with a major length-age group (age 1) in the fall fishery, and these were caught entirely off Beaufort, prior to the appearance of the large schools in the vicinity of Cape Hatteras (June and Reintjes, 1960).

There also was good agreement between the relative strengths of major length-age groups in the end-of-season catches in the different areas (a reflection of abundance) and their representation in the fall fishery. In 1955, for example, age-4 (1951 year class) dominated in the Middle and North Atlantic Areas and formed

TABLE 9.--Mean weight (grams) of Atlantic menhaden at each age in samples from purse seine catches, by area and season, 1955-58

[Most numerous age group underscored]

Season, area and year	Age group											Weighted mean
	0	1	2	3	4	5	6	7	8	9	10	
SUMMER FISHERY												
South Atlantic:												
1955	35	82	125	155	157	--	--	--	--	--	--	98
1956	--	67	134	176	217	224	--	--	--	--	--	69
1957	32	83	117	190	--	--	--	--	--	--	--	102
1958	40	84	120	143	157	--	--	--	--	--	--	96
Chesapeake Bay:												
1955	60	142	222	262	278	235	--	--	--	--	--	185
1956	--	118	196	388	--	--	--	--	--	--	--	125
1957	68	97	171	181	257	327	--	--	--	--	--	108
1958	28	119	162	214	469	480	--	--	--	--	--	142
Middle Atlantic:												
1955	--	225	317	404	457	505	596	712	543	--	--	385
1956	--	206	305	448	522	582	629	643	688	--	--	359
1957	--	149	257	429	589	608	621	535	630	634	--	270
1958	--	183	260	319	506	578	617	--	--	--	--	262
North Atlantic:												
1955	--	--	401	426	494	589	641	691	732	760	774	514
1956	--	--	395	444	521	565	615	658	725	766	--	522
1957	--	190	352	471	566	607	638	660	706	612	--	497
1958	--	181	317	493	588	661	693	711	833	--	--	448
FALL FISHERY												
North Carolina:												
1955	31	166	356	460	566	648	690	--	806	--	--	256
1956	28	116	346	516	563	582	642	643	--	--	--	373
1957	35	94	452	540	606	636	646	664	784	--	--	450
1958	26	155	360	573	668	722	741	756	--	--	--	344

a large portion of the North Carolina fall catch. The data for 1958 reflected the dominance of age-2 fish (1956 year class) and the abrupt decline of older age groups in the North Atlantic Area. This also was the first season on record in which the older age groups failed to congregate in large schools off the coast of southern Long Island in September and October (p. 5).

The conclusion drawn from these data is that when the schools disappeared from the summer fishing grounds north of Cape Hatteras, some portion (if not all) of the various stocks migrated southward and, in doing so, passed along the North Carolina coast and provided the basis for the fall fishery off Beaufort in November and December. Because of adverse weather and selective fishing by the fleet, portions of the migrating stocks, particularly the smaller fish in the younger age groups, may not have been represented in the North Carolina fall catches in proportion to their abundance on the fishing grounds (June and Reintjes, 1959 and 1960; June, 1961).

Further evidence in support of a southward migration in autumn, followed by a return northward migration, is based on a comparison of length frequencies of the major year classes caught at the beginning of the summer fishery (April 1 - June 15) in the different areas (lower five panels of fig. 9 and table 11) with those caught in the North Carolina fishery in the previous fall (table 10). Data for the beginning of the 1959 summer fishery were included for comparative purposes.

The most striking features of these curves are (1) the heterogeneity of the length-age curves in the different areas, (2) the absence at the beginning of the summer fishery in the

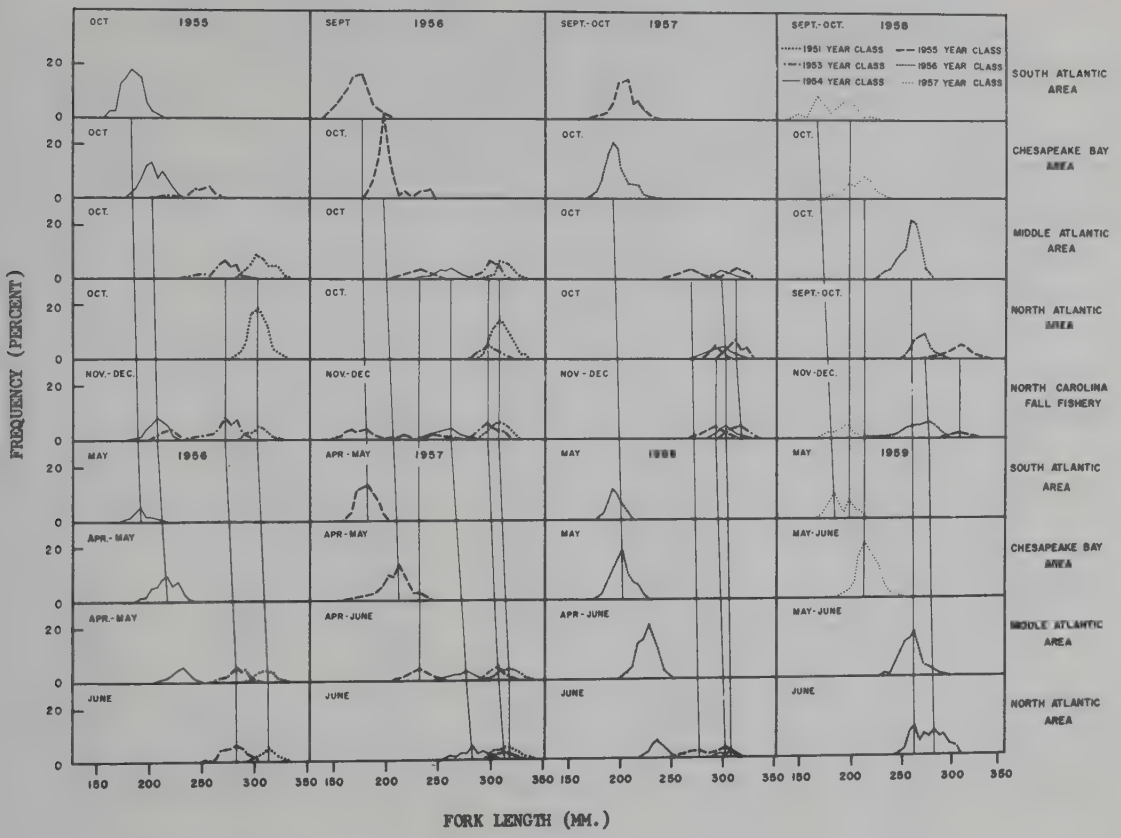

Figure 9.--Comparison of length frequencies of major year classes in the end-of-season (October) and beginning-of-season catches of Atlantic menhaden (April-June 15), by area, with those in the North Carolina fall fishery, 1955-59.

South Atlantic Area (and in Chesapeake Bay) of larger, older fish represented in the previous fall off North Carolina; (3) the gradual increase from south to north in length of fish comprising the youngest age groups; (4) the occurrence at the beginning of the summer fishery in the Middle and/or North Atlantic Areas of the major length-age groups (actually one year older) represented in the previous fall catch off North Carolina; and (5) the absence of small, young fish in northern waters.

Lengths of the major age groups caught at the beginning of the summer fishery (lower four panels of figure 9) were most similar to those caught in the same area (at the previous age) at the close of the preceding summer fishery (upper four panels of figure 9). Lines fitted by eye through modes judged to be homologous offer evidence of a return in spring of at least a portion of the stock to the area occupied in the previous fall. In most instances, however, particularly among the younger age groups, there was slight shift of modes to the right due to growth and/or mixing of stocks. There also was good agreement between the mean lengths of fish in the major year classes caught at the close of summer fishery and those a year older caught in the same area at the beginning of the succeeding summer fishery (tables 10 and 11). The overlap in the length-age curves for areas north of Cape Hatteras suggests mixing of fish between seasons, with the largest individuals in each of the younger age groups distributed

TABLE 10.--Mean length (in millimeters) of major age groups in end-of-season catches (October) of Atlantic menhaden, by area, and in the North Carolina fall fishery, 1955-58

Year and age group	Summer fishing areas in--				Fall fishing area in North Carolina
	South Atlantic	Chesapeake Bay	Middle Atlantic	North Atlantic	
1955:					
Age: 1	184	204	--	--	209
2	--	--	270	--	259
3	--	--	--	--	--
4	--	--	305	303	304
1956:					
Age: 1	170	209	233	--	171
2	--	--	259	--	262
3	--	--	300	298	298
4	--	--	--	--	--
5	--	--	313	310	312
1957:					
Age: 1	--	197	--	--	181
2	205	--	267	290	285
3	--	--	299	303	302
4	--	--	312	312	314
1958:					
Age: 1	182	205	--	--	202
2	--	--	257	270	264
3	--	--	--	302	304

farthest northward at the beginning of each successive summer season.

Further evidence of mixing between seasons is provided by the increased proportion of successive age groups in each more northerly area and a decrease in the proportion of older fish in adjacent southerly areas at the beginning of the summer fishery. This pattern is most striking in the Chesapeake Bay and Middle Atlantic Areas. The lengths of age-2 fish in the South Atlantic Area at the beginning of the summer fishery most closely resembled those of age-1 fish caught in that area in the previous September or October. That fish in the South Atlantic Area apparently furnished few recruits to the Middle Atlantic stock is obvious from the nearly complete separation of the length-age curves for the two areas, but the extent to which they may have participated in the north-south migration of stocks north of Cape Hatteras cannot be determined from the data presented. It is probable that the fish which occupied North Carolina waters prior to the appearance of the larger fish in November also migrated southward, for an influx of fish into northern Florida waters in late October and November, similar in length-age to those caught in North Carolina waters just prior to the disappearance of the summer stock in September or early October, was sufficiently great in some years to permit operation of a plant located at Fernandina Beach (see p. 3 and June and Reintjes, 1959). It thus would appear that the summer stock in the South Atlantic Area does not mix to any great extent with those farther northward.

The foregoing hypothesis of a cyclic north-south migration (with mixing taking place between seasons) of two major population components, one occurring north of Cape Hatteras

TABLE 11.--Mean length (in millimeters) of major age groups in beginning-of-season catches (April-June 15) of Atlantic menhaden, by area, 1956-59

Year and age group	Area			
	South Atlantic	Chesapeake Bay	Middle Atlantic	North Atlantic
1956:				
Age: 2.....	172	216	230	--
3.....	--	--	284	279
4.....	--	--	--	--
5.....	--	--	309	312
1957:				
Age: 2.....	181	208	229	266
3.....	--	--	277	284
4.....	--	--	302	307
5.....	--	--	--	--
6.....	--	--	317	318
1958:				
Age: 2.....	192	201	226	238
3.....	--	--	--	283
4.....	--	--	--	--
5.....	--	--	--	306
1959:				
Age: 2.....	188	216	--	--
3.....	--	--	259	269
4.....	--	--	--	--

and the other occurring south of that location, probably is oversimplified. This interpretation, however, is consistent with other evidence based on the time and place of spawning (Higham and Nicholson[7]) and morphological differences in juveniles (June, 1958; Sutherland, 1963) which suggests separation of the population into two biologically distinct groups. Based on the length-age curves of the several year classes considered, it appears that at least an identifiable portion of the summer stocks in the major areas north of Cape Hatteras migrated southward along the North Carolina coast in fall. Some time prior to or during the return northward migration, the fish apparently became mixed so that their range was extended in successive years of life. From the data presented, it is not possible to determine whether all or only a portion of the summer stocks in areas north of Cape Hatteras participated in the southward migration in fall, nor is it possible to determine the extent of mixing of stocks between seasons. More information may be obtained on these aspects of the migrations from a more detailed study of the length and age data and abundance indices and, of course, by tagging experiments.

[7] Joseph R. Higham and William R. Nicholson. Sexual maturation and spawning of Atlantic menhaden. Unpublished MS., Bureau of Commercial Fisheries Biological Laboratory, Beaufort, N. C.

The 1958 purse seine fishery will now be reviewed in the light of the data summarized in the preceding sections of the report and the hypotheses developed there.

The catch (in tons) in 1958 declined for the third consecutive season and was only 73 percent of the record catch in 1956, but 84 percent of the average catch for 1952-57. The reasons for the continued decrease are not completely understood, but one of the important factors undoubtedly was the variation in relative strength of individual year classes (June, 1961). In 1955, for example a good catch resulted primarily from the combined contributions of two strong year classes, those of 1951 (age-4 fish) and 1953 (age-2 fish). The incoming 1954 year class (age-5 fish) made a weak showing in that year. In 1956, a record catch was produced mainly as a result of the continuing heavy contributions of the 1953 (age-3 fish) and 1951 (age-5 fish) year classes, combined with the strong entry of the 1955 year class (age-1 fish). The contribution of the 1955 year class in that year was more than three times that of the 1954 year class at the same age in 1955; the latter year class at age 2 in 1956 continued to make a weak showing. Although the catch declined slightly in 1957, it was maintained at a relatively high level by the continuing strong contribution of the 1955 year class (age-2 fish) and a strong entry of the 1956 year class (age-1 fish). The 1953 (age-4 fish) and 1951 (age-6 fish) year classes also continued to make important contributions to the catch in that year. In 1958, the contribution by the newly recruited 1957 year class (age-1 fish) was the smallest since that of the 1954 year class (age 1 in 1955) and amounted to about two-fifths that of the 1955 year class and about one-half that of the 1956 year class at the same age. Catch per unit of effort of the 1957 year class in numbers of fish (31,000) was less than half that contributed by the 1955 year class at the age 1 in 1956 (65,000) and less than three-fourths that contributed by the 1956 year class (42,000) in 1957.

Assuming that the same proportion of each incoming year class was available to the fishery during the past 4 seasons, it would appear that the 1954 and 1957 year classes were weak, while the 1955 and 1956 year classes were strong, and the relative strength of each new year class was reflected in the season's catch.

Contributions by older year classes also continued to decline and in 1958 were the smallest in the past 4 seasons. In 1955, fish of age 3 and older ages accounted for 20 percent of the catch in numbers of fish; in 1956, 16 percent; in 1957, 9 percent; and in 1958, 4 percent. While data are available for only 4 seasons, it would appear that the increased exploitation of ages 1 and 2 (estimated at approximately 20 percent) may have been sufficiently great to have removed a disproportionate number of each new year class, with the result that the catch by number (and weight) of older fish has declined accordingly. The apparent decrease in abundance of older age groups and the greater dependence on a single year class makes the fishery much more susceptible to wide fluctuations in yield in the future.

In the South Atlantic Area, the 1958 catch was about average for the past 5 summer seasons, but greater than that in the 1957. Based on the unadjusted effort data, it would appear that schools were more numerous than in the previous 3 seasons, but smaller in size. Although earlier year classes at ages 1-3 individually made greater contributions to the catch in previous seasons (the contribution by the 1955 year class at age 1 in 1956, for example, was over three and one-half times that of the 1957 year class at the same age in 1958, and the contribution by the 1955 year class at age 2 in 1957 was over one and one-half times that of the 1956 year class at the same age in 1958), the increased catch in 1958 may be traced to the combined contributions of three successive year classes, 1955-57. The mean length and weight of fish in the catch was below that in 1957 and resulted from a greater proportion of age-1 fish (1957 year class). Based on the length-age data presented earlier in this section and discrepancies between this and other areas in year-class strength, recruitment pattern, mean length and weight at each age, and derived total annual mortality rates, it would appear that the summer fishery in the area was dependent upon a separate stock.

In Chesapeake Bay, the 1958 catch was greater than in 1957 and only 4,000 tons below the recent record catch produced in 1955. Unadjusted effort data indicated that schools were about average in size, but more numerous than in the previous 3 seasons. Although the contribution to the catch of the 1957 year class (age-1 fish) was below average, the contribution of the 1956 year class (age-2 fish) was greater than that of any of the previous three year classes. The contribution of the 1955 year class at age 3 was exceeded only by that of the 1952 year class in 1955. Thus it would appear that the large catch in the area in 1958 resulted mainly from the combined contributions of three successive year classes 1955-57. The increase in the mean length and weight of fish in the catch over that of the previous 2 seasons was due to the greater proportion of age-2 fish, although the mean length and weight of this age group was the least in 4 seasons.

In the Middle Atlantic Area, the catch declined for the third successive year and was the smallest since 1952. The total number of sets declined, but the catch per set was above average. The contribution to the catch by the 1956 year class (age-2 fish) was above average, while those of all other year classes were below average. For the first time in the recent history of the fishery, large, older fish failed to congregate in quantity off the southern shore of Long Island in September and October. Schools were reported in increased abundance in Long Island Sound and off the eastern end of Long Island during the first 2 weeks in September, and heavy catches were made in these localities by the fleet from Amagansett, N. Y., during a 2-week period beginning September 15, but apparently the fish did not follow the "usual" seasonal migration pattern. The failure of the older age groups to congregate in large schools off southern Long Island is inexplicable. It would appear that the decrease in the 1958 catch was mainly attributable to the reduced quantities of fish of age 3 and older ages which in prior years contributed substantially to the late summer fishery in the northern part of the area. The mean length and weight of fish in the catch decreased in 1958 primarily because of the reduced contributions of older age groups; however, the mean length and weight of age-2 fish which dominated the catch also was below average.

The catch in the North Atlantic Area decreased for the third consecutive season. It was less than half that produced in 1957 and the smallest since 1953. Both the number of sets and the average catch per set were greatly reduced in 1958. The catch was supported primarily by the strong 1955 (age-3 fish) and 1956 (age-2 fish) year classes. The contributions of all older year classes, except that of 1951, were below average. The 1951 year class at age 7, however, was too few in numbers to have an important influence on the catch. A decrease in the mean length and weight of fish in 1958 reflected both a reduction in the contributions of older age groups and the smaller size of age-2 fish which dominated the catch.

The catch in the fall fishery off North Carolina increased over that in 1957 and exceeded the average for the past 5 years. Availability of fish on the grounds was good through most of the season, and fair weather enabled the fleet to fish a greather-than-average number of days. The contribution to the catch by the strong 1956 year class (age-2 fish) was greater than that of any of the previous three year classes at the same age. This, along with average contributions by the 1957 (age-1 fish) and 1955 (age-3 fish) year classes and the sustained contribution by the 1951 year class (age-7 fish), resulted in a near-record catch. Mean length and weight of fish in the catch was average; however, the mean size of age-2 fish was below the average for the previous 3 seasons.

As in previous years, there was remarkable similarity between the summer catch in the North Atlantic Area and the fall catch off North Carolina in the contributions of all age groups beyond age 2. There also was close agreement in the average lengths and weights of fish at each age caught in the two fisheries. These findings have been consistent for the past 4 seasons and, combined with the length-age data discussed earlier in this section, offer convincing evidence that at least a portion of the summer stock in the North Atlantic Area was represented in the North Carolina

fall fishery. Assuming that the two groups of fish belong to essentially the same stock, it would appear from the decrease in catch per unit of effort and increases in mean lengths and weights of fish at each age that a decrease in the abundance of older age groups had occurred over the past several years.

SUMMARY

1. This is the fourth in a series of reports which summarizes and discusses data regarding the age composition, size, and sex ratio of Atlantic menhaden *(Brevoortia tyrannus)* caught by the purse seine fishery during the 1958 fishing season. The data were obtained from a coastwise catch-sampling program for purposes of continuing studies on the biology, structure, and dynamics of the Atlantic menhaden population.

2. The purse seine catch, 540,000 tons, declined for the second successive year and was the smallest in the past 4 years; 462,000 tons were landed in the summer fishery and 78,000 tons in the fall fishery. A total of 24,545 purse seine sets represented a decrease of 22 percent from that in 1957. Catch per set was 22 tons, compared to 20 tons in 1957. The greatest portion of the catch was taken in the Middle Atlantic Area (43 percent) and the smallest, in the North Atlantic Area (6 percent).

3. In the South Atlantic Area, summer catches off Florida were the smallest in 10 seasons, while off the Carolinas, schools were numerous, and heavy catches were recorded during June and July. Although fish were scarce over most of this area in August, several large, migratory schools which appeared off Cape Lookout in September provided good late-summer catches. Except for the slow start and interruption by a hurricane in August, the summer fishery in Chesapeake Bay area was productive throughout. Poor catches were produced at both ends of the fishing season in the Middle Atlantic Area, but heavy landings were made during mid-summer. The large schools which in previous seasons provided good catches off southern Long Island in September and October failed to appear. Catches in the North Atlantic Area were sporadic through the season. In the North Carolina fall fishery, above-average availability of fish and fair weather were responsible for a near-record catch.

4. Two noteworthy variations in the distribution of fishing activities included (1) a decrease in the number of sets at both ends of the fishing range and (2) offshore extension of fishing in the Middle Atlantic Area.

5. The 1956 year class (age-2 fish) dominated the catch (61 percent) with a contribution of 1.7 billion fish. This was the largest contribution at age 2 by recent year classes. This year class was the most abundant one in the summer catches from Chesapeake Bay northward. In the South Atlantic Area, fish of the 1957 year class (age 1) were most numerous in the summer fishery, while in the fall fishery off North Carolina, those of the 1958 year class (age 0) were most numerous; however, in both fisheries, the 1956 year class accounted for the greatest share of the catch by weight. There was a reduction in the number of fish contributed by older year classes.

6. Fish of the dominant 1956 year class were shorter and, in general, lighter than those of the previous three year classes at the same age. There was a tendency for fish in the older age groups to be slightly larger than those of comparable ages in previous seasons.

7. A north-south cyclic migration and isolation of the summer stock in the South Atlantic Area were hypothesized on the basis of length-age data collected during successive fishing seasons.

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catch samples, made available their records of vessel landings, and in many ways contributed to the success of the catch-sampling program. Special thanks are extended to the individual vessel captains and pilots who kept detailed logs of their daily fishing operations.

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APPENDIX TABLE 1.--Length frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, South Atlantic Area, 1958

[M = male; F = female; U = unidentified; T = total.]

Fork length	Number of Fish by age group and sex																		Total of all age groups
	0			1				2				3			4				
	M	F	T	M	F	U	T	M	F	U	T	M	F	T	M	F	T		
Mm.																			
95-99	--	--	--	--	1	--	1	--	--	--	--	--	--	--	--	--	--		1
100-104	--	--	--	5	1	2	8	--	--	--	--	--	--	--	--	--	--		8
105-109	--	--	--	2	7	--	9	--	--	--	--	--	--	--	--	--	--		9
110-114	--	--	--	6	1	1	8	--	--	--	--	--	--	--	--	--	--		8
115-119	--	--	--	3	3	1	7	--	--	--	--	--	--	--	--	--	--		7
120-124	1	--	1	6	4	--	10	--	--	--	--	--	--	--	--	--	--		11
125-129	--	--	--	7	1	--	8	--	--	--	--	--	--	--	--	--	--		8
130-134	--	--	--	13	10	1	24	--	--	--	--	--	--	--	--	--	--		24
135-139	--	--	--	24	10	--	34	--	--	--	--	--	--	--	--	--	--		34
140-144	1	--	1	35	19	--	54	--	--	--	--	--	--	--	--	--	--		55
145-149	--	--	--	52	37	1	90	--	--	--	--	--	--	--	--	--	--		90
150-154	--	--	--	70	58	--	128	2	2	--	4	--	--	--	--	--	--		132
155-159	--	--	--	71	54	1	126	6	3	--	9	--	--	--	--	--	--		135
160-164	--	--	--	56	60	--	116	10	5	--	15	--	--	--	--	--	--		131
165-169	--	--	--	76	54	1	131	5	6	--	11	--	--	--	--	--	--		142
170-174	--	--	--	64	79	--	143	14	8	--	22	--	--	--	--	--	--		165
175-179	--	--	--	44	45	1	90	18	14	--	32	--	--	--	--	--	--		122
180-184	--	--	--	45	45	1	91	48	34	--	82	1	1	2	--	--	--		175
185-189	--	--	--	36	38	1	75	52	39	2	93	--	1	1	--	--	--		169
190-194	--	--	--	44	36	1	81	52	64	--	116	3	2	5	--	--	--		202
195-199	--	--	--	33	33	--	66	41	38	--	79	6	1	7	--	--	--		152
200-204	--	--	--	19	20	--	39	28	32	--	60	6	6	12	--	--	--		111
205-209	--	--	--	6	18	--	24	17	17	--	34	4	2	6	--	--	--		64
210-214	--	--	--	6	4	--	10	6	7	--	13	1	1	2	1	--	1		26
215-219	--	--	--	4	3	--	7	7	8	--	15	1	1	2	--	--	--		24
220-224	--	--	--	1	3	--	4	--	1	--	1	--	1	1	--	--	--		6
225-229	--	--	--	1	--	--	1	2	--	--	2	--	--	--	--	--	--		3
230-234	--	--	--	--	1	--	1	--	2	--	2	--	--	--	--	--	--		3
235-239	--	--	--	--	1	--	1	1	--	--	1	--	1	1	--	--	--		3
240-244	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		--
245-249	--	--	--	--	--	--	--	--	1	--	1	--	--	--	--	--	--		1
Total	2	--	2	729	646	12	1,387	309	281	2	592	22	17	39	1	--	1		2,021

APPENDIX TABLE 2.--Length frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, Chesapeake Bay Area, 1958

[M = male; F = female, U = unidentified; T = total.]

Fork length	Number of fish by age group and sex																					Total of all age groups
	0				1				2				3			4			5			
	M	F	U	T	M	F	U	T	M	F	U	T	M	F	T	M	F	T	M	F	T	
Mm.																						
100-104	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
105-109	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110-114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115-119	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
120-124	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125-129	-	-	1	1	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
130-134	-	-	-	-	2	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
135-139	-	-	-	-	2	7	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	9
140-144	-	-	-	-	11	10	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	21
145-149	-	-	-	-	15	15	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	30
150-154	-	-	-	-	21	16	1	38	-	-	-	-	-	-	-	-	-	-	-	-	-	38
155-159	-	-	-	-	23	22	-	45	-	-	-	-	-	-	-	-	-	-	-	-	-	45
160-164	-	-	-	-	29	21	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	50
165-169	-	-	-	-	39	27	-	66	-	-	-	-	-	-	-	-	-	-	-	-	-	66
170-174	-	-	-	-	36	33	-	69	1	-	-	1	-	-	-	-	-	-	-	-	-	70
175-179	-	-	-	-	49	38	1	88	3	3	-	6	-	-	-	-	-	-	-	-	-	94
180-184	-	-	-	-	63	46	-	109	7	2	-	9	-	-	-	-	-	-	-	-	-	118
185-189	-	-	-	-	78	68	-	146	19	18	-	37	-	-	-	-	-	-	-	-	-	183
190-194	-	-	-	-	69	70	-	139	32	25	-	57	-	-	-	-	-	-	-	-	-	196
195-199	-	-	-	-	90	94	-	184	65	47	-	112	-	-	-	-	-	-	-	-	-	296
200-204	-	-	-	-	64	58	1	123	106	70	-	176	-	-	-	-	-	-	-	-	-	299
205-209	-	-	-	-	48	47	-	95	117	88	1	206	-	-	-	-	-	-	-	-	-	301
210-214	-	-	-	-	52	47	-	99	138	127	-	265	-	-	-	-	-	-	-	-	-	364
215-219	-	-	-	-	29	37	1	67	133	128	1	262	2	-	2	-	-	-	-	-	-	331
220-224	-	-	-	-	14	25	1	40	90	115	6	211	1	-	1	-	-	-	-	-	-	252
225-229	-	-	-	-	8	14	-	22	55	54	3	112	-	1	1	-	-	-	-	-	-	135
230-234	-	-	-	-	4	10	2	16	31	48	3	82	-	1	1	-	-	-	-	-	-	99
235-239	-	-	-	-	2	1	-	3	15	25	2	42	-	1	1	-	-	-	-	-	-	46
240-244	-	-	-	-	-	3	-	3	7	9	2	18	3	-	3	-	-	-	-	-	-	24
245-249	-	-	-	-	-	-	-	-	-	7	1	8	1	-	1	-	-	-	-	-	-	9
250-254	-	-	-	-	1	-	-	1	2	2	-	4	1	2	3	-	-	-	-	-	-	8
255-259	-	-	-	-	-	-	-	-	-	2	-	2	-	1	1	-	-	-	-	-	-	3
260-264	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	1
265-269	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
270-274	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
275-279	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
280-284	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
285-289	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	1
290-294	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
295-299	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
300-304	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
305-309	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
310-314	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
315-319	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1
Total	1	-	1	2	750	711	7	1,468	822	771	19	1,612	8	6	14	1	1	2	-	1	1	3,099

APPENDIX TABLE 3.--Length frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, Middle Atlantic Area, 1958

[M = male; F = female; U = unidentified; T = total.]

Fork length	Number of fish by age group and sex																		Total of all age group
	1			2				3			4			5			6			
	M	F	T	M	F	U	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																				
155-159	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
160-164	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
165-169	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
170-174	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
175-179	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
180-184	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
185-189	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
190-194	4	-	4	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	6
195-199	3	1	4	3	3	-	6	-	-	-	-	-	-	-	-	-	-	-	-	10
200-204	4	3	7	8	5	-	13	-	-	-	-	-	-	-	-	-	-	-	-	20
205-209	3	5	8	22	14	-	36	-	-	-	-	-	-	-	-	-	-	-	-	44
210-214	1	3	4	61	41	-	102	1	-	1	-	-	-	-	-	-	-	-	-	107
215-219	6	4	10	124	78	-	202	-	1	1	-	-	-	-	-	-	-	-	-	213
220-224	8	1	9	211	164	2	377	2	2	4	-	-	-	-	-	-	-	-	-	390
225-229	7	6	13	363	259	1	623	5	5	10	-	-	-	-	-	-	-	-	-	646
230-234	5	6	11	410	366	1	777	13	7	20	-	-	-	-	-	-	-	-	-	808
235-239	3	5	8	395	387	1	783	4	7	11	-	-	-	-	-	-	-	-	-	802
240-244	1	2	3	326	353	-	679	7	9	16	-	-	-	-	-	-	-	-	-	698
245-249	1	-	1	248	303	-	551	2	17	19	-	-	-	-	-	-	-	-	-	571
250-254	-	1	1	224	255	-	479	12	10	22	-	-	-	-	-	-	-	-	-	502
255-259	-	-	-	163	221	-	384	7	11	18	-	-	-	-	-	-	-	-	-	402
260-264	-	-	-	87	128	-	215	7	11	18	-	-	-	-	-	-	-	-	-	233
265-269	-	-	-	22	89	-	111	2	9	11	-	-	-	-	-	-	-	-	-	122
270-274	-	-	-	4	28	-	32	2	5	7	-	-	-	-	-	-	-	-	-	39
275-279	-	-	-	1	5	-	6	5	1	6	-	1	1	-	-	-	-	-	-	13
280-284	-	-	-	-	3	-	3	3	2	5	-	-	-	-	-	-	-	-	-	8
285-289	-	-	-	1	-	-	1	1	2	3	1	-	1	-	-	-	-	-	-	5
290-294	-	-	-	1	-	-	1	2	2	4	-	-	-	-	1	1	-	-	-	6
295-299	-	-	-	-	-	-	-	-	2	2	2	-	2	-	-	-	-	-	-	4
300-304	-	-	-	-	-	-	-	-	2	2	3	1	4	-	-	-	-	-	-	6
305-309	-	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-	-	-	-	2
310-314	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
315-319	-	-	-	-	-	-	-	-	-	-	-	2	2	1	1	2	-	2		5
320-324	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	2
325-329	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
330-334	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Total	51	45	96	2,676	2,702	5	5,383	76	107	183	6	4	10	-	4	4	2	1	3	5,679

APPENDIX TABLE 4.--Length frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, North Atlantic Area, 1958

[M = male; F = female; U = unidentified; T = total.]

Fork length	Number of fish by age group and sex																								Total of all age groups
	1			2				3			4			5			6			7			8			
	M	F	T	M	F	U	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																										
200-204....	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
205-209....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210-214....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
215-219....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220-224....	-	1	1	3	2	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
225-229....	2	-	2	13	7	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
230-234....	-	-	-	22	14	-	36	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
235-239....	1	-	1	39	28	-	67	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	71
240-244....	-	-	-	75	40	-	115	1	7	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	123
245-249....	-	-	-	78	60	-	138	2	5	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	145
250-254....	-	-	-	76	78	1	155	9	4	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168
255-259....	-	-	-	84	68	-	152	8	8	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	168
260-264....	-	-	-	59	57	-	116	5	12	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	133
265-269....	-	-	-	44	46	-	90	14	11	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	115
270-274....	-	-	-	40	29	-	69	13	14	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	96
275-279....	-	-	-	17	24	-	41	16	10	26	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	68
280-284....	-	-	-	5	11	-	16	20	9	29	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	46
285-289....	-	-	-	1	5	-	6	20	8	28	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	36
290-294....	-	-	-	1	4	-	5	25	18	43	7	2	9	1	-	1	-	-	-	-	-	-	-	-	-	58
295-299....	-	-	-	2	-	-	2	20	25	45	15	2	17	2	-	2	-	-	-	-	-	-	-	-	-	66
300-304....	-	-	-	-	1	-	1	38	28	66	18	6	24	5	1	6	2	-	2	-	-	-	-	-	-	99
305-309....	-	-	-	-	-	-	-	36	26	62	24	15	39	7	1	8	3	-	3	2	-	2	-	-	-	114
310-314....	-	-	-	-	-	-	-	15	34	49	17	26	43	14	8	22	8	1	9	1	-	1	-	-	-	124
315-319....	-	-	-	-	-	-	-	6	30	36	15	16	31	19	14	33	7	5	12	2	3	5	-	-	-	117
320-324....	-	-	-	-	-	-	-	2	13	15	3	14	17	15	19	34	19	10	29	6	6	12	-	-	-	107
325-329....	-	-	-	-	-	-	-	1	8	9	-	6	6	8	26	34	5	14	19	6	6	12	-	-	-	80
330-334....	-	-	-	-	-	-	-	-	5	5	1	5	6	3	14	17	7	12	19	1	6	7	-	1	1	55
335-339....	-	-	-	-	-	-	-	-	-	-	-	1	1	1	7	8	2	10	12	4	7	11	-	-	-	32
340-344....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	1	10	11	1	9	10	-	1	1	26
345-349....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	3	3	-	4	4	-	-	-	8
350-354....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	7	-	1	1	1	1	2	10
355-359....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
Total....	4	1	5	559	474	1	1,034	253	277	530	102	95	197	75	95	170	54	13	127	23	42	65	1	3	4	2,132

APPENDIX TABLE 5.--Length frequency distributions in samples from purse-seine catches of Atlantic menhaden, North Carolina fall fishery, 1958

[M = male; F = female; U = unidentified; T = total.]

Fork length	Number of fish by age group and sex																								Total of all age groups
	0				1				2			3			4			5			6			7			
	M	F	U	T	M	F	U	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																											
70-74.....	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
75-79.....	7	2	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
80-84.....	12	2	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
85-89.....	9	8	1	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
90-94.....	5	9	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
95-99.....	1	2	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
100-104....	6	4	1	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
105-109....	4	10	11	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
110-114....	11	8	6	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
115-119....	8	13	5	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
120-124....	16	10	7	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
125-129....	9	9	2	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
130-134....	13	10	8	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
135-139....	9	5	4	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
140-144....	8	5	1	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
145-149....	2	4	1	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
150-154....	1	4	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
155-159....	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
160-164....	5	2	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
165-169....	-	-	-	-	2	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
170-174....	-	-	-	-	2	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
175-179....	-	-	-	-	8	3	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
180-184....	-	-	-	-	20	14	-	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34
185-189....	-	-	-	-	25	12	1	38	1	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
190-194....	-	-	-	-	28	20	-	48	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
195-199....	-	-	-	-	24	24	-	48	3	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55
200-204....	-	-	-	-	20	18	-	38	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45
205-209....	-	-	-	-	8	15	-	23	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
210-214....	-	-	-	-	15	11	-	26	3	3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
215-219....	-	-	-	-	9	13	-	22	7	2	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31

APPENDIX TABLE 5.--Length frequency distributions in samples from purse-seine catches of Atlantic menhaden, North Carolina fall fishery, 1958--Continued

[Male = male; F = female; U = unidentified; T = total.]

Fork length	Number of fish by age group and sex																									Total of all age groups
	0				1				2			3			4			5			6			7			
	M	F	U	T	M	F	U	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Mm.																											
200-224	-	-	-	-	2	6	-	8	4	5	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
225-229	-	-	-	-	3	6	-	9	8	-	8	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	18
230-234	-	-	-	-	2	1	-	3	5	4	9	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	13
235-239	-	-	-	-	4	3	-	7	8	3	11	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	19
240-244	-	-	-	-	-	3	-	3	12	3	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
245-249	-	-	-	-	2	1	-	3	24	7	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34
250-254	-	-	-	-	2	1	-	3	43	21	64	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	68
255-259	-	-	-	-	1	1	-	2	43	30	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75
260-264	-	-	-	-	-	1	-	1	42	38	80	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	83
265-269	-	-	-	-	-	1	-	1	40	35	75	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	78
270-274	-	-	-	-	2	1	-	3	49	42	91	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	95
275-279	-	-	-	-	-	-	-	-	61	36	97	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	104
280-284	-	-	-	-	-	1	-	1	39	54	93	4	4	8	1	-	1	-	-	-	-	-	-	-	-	-	103
285-289	-	-	-	-	-	-	-	-	16	25	41	2	-	2	1	-	1	-	-	-	-	-	-	-	-	-	44
290-294	-	-	-	-	-	-	-	-	8	15	23	8	7	15	1	-	1	-	-	-	-	-	-	-	-	-	39
295-299	-	-	-	-	-	-	-	-	2	3	5	10	10	20	2	-	2	-	-	-	-	-	-	-	-	-	27
300-304	-	-	-	-	-	-	-	-	1	3	4	14	9	23	2	1	3	-	1	1	-	-	-	-	-	-	31
305-309	-	-	-	-	-	-	-	-	-	-	-	14	15	29	8	4	12	4	1	5	1	-	1	-	-	-	47
310-314	-	-	-	-	-	-	-	-	-	2	2	10	17	27	7	4	11	6	3	9	1	-	1	1	-	1	51
315-319	-	-	-	-	-	-	-	-	-	-	-	7	11	18	8	9	17	8	5	13	6	2	8	1		1	57
320-324	-	-	-	-	-	-	-	-	-	-	-	3	12	15	6	6	12	8	10	18	4	4	8	2	4	6	59
325-329	-	-	-	-	-	-	-	-	-	-	-	1	5	6	-	5	5	1	19	20	3	3	6	1	4	5	42
330-334	-	-	-	-	-	-	-	-	-	-	-	1	4	5	1	3	4	1	11	12	2	7	9	2	4	6	36
335-339	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	3	3	1	5	6	-	7	7	-	5	5	22
340-344	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	4	4	-	1	1	-	2	2	8
345-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	2
350-354	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
355-359	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
Total	128	109	48	285	179	158	1	338	423	345	768	84	102	186	37	35	72	29	59	88	17	26	43	7	20	27	1,807

APPENDIX TABLE 6.--Weight frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, South Atlantic Area, 1958

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex															Total of all age groups
	0			1			2			3			4			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																
10-19....	-	-	-	7	4	13	-	-	-	-	-	-	-	-	-	13
20-29....	-	-	-	11	8	21	-	-	-	-	-	-	-	-	-	21
30-39....	1	-	1	29	11	40	-	-	-	-	-	-	-	-	-	41
40-49....	1	-	1	59	29	90	-	-	-	-	-	-	-	-	-	91
50-59....	-	-	-	115	78	193	1	3	4	-	-	-	-	-	-	197
60-69....	-	-	-	103	99	203	11	3	14	-	-	-	-	-	-	217
70-79....	-	-	-	90	92	183	9	9	18	-	-	-	-	-	-	201
80-89....	-	-	-	74	75	150	20	15	35	-	-	-	-	-	-	185
90-99....	-	-	-	51	54	107	39	19	59	-	-	-	-	-	-	166
100-109..	-	-	-	34	39	73	49	51	100	1	1	2	-	-	-	175
110-119..	-	-	-	47	37	85	45	37	83	3	1	4	-	-	-	172
120-129..	-	-	-	34	37	71	39	55	94	4	1	5	-	-	-	170
130-139..	-	-	-	33	21	54	45	31	76	5	5	10	-	-	-	140
140-149..	-	-	-	16	26	42	16	18	34	4	2	6	-	-	-	82
150-159..	-	-	-	9	11	20	9	15	24	2	4	6	1	-	1	51
160-169..	-	-	-	7	13	20	10	4	14	-	1	1	-	-	-	35
170-179..	-	-	-	5	5	10	5	8	13	2	-	2	-	-	-	25
180-189..	-	-	-	3	2	5	4	3	7	1	-	1	-	-	-	13
190-199..	-	-	-	-	1	1	2	5	7	-	1	1	-	-	-	9
200-209..	-	-	-	1	1	2	-	2	2	-	-	-	-	-	-	4
210-219..	-	-	-	1	1	2	3	-	3	-	-	-	-	-	-	5
220-229..	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
230-239..	-	-	-	-	1	1	1	-	1	-	1	1	-	-	-	3
240-249..	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2
250-250..	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	1
260-269..	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
270-279..	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
280-289..	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
290-299..	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300-309..	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
310-319..	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
Total..	2	-	2	729	646	1,387	309	281	592	22	17	39	1	-	1	2,021

APPENDIX TABLE 7.--Weight frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, Chesapeake Bay area, 1958

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex																		Total of all age groups
	0			1			2			3			4			5			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																			
20-29	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
30-39	-	-	1	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
40-49	-	-	-	25	24	50	-	-	-	-	-	-	-	-	-	-	-	-	50
50-59	-	-	-	33	28	61	-	-	-	-	-	-	-	-	-	-	-	-	61
60-69	-	-	-	37	26	63	-	-	-	-	-	-	-	-	-	-	-	-	63
70-79	-	-	-	43	46	89	-	-	-	-	-	-	-	-	-	-	-	-	89
80-89	-	-	-	44	39	83	4	2	6	-	-	-	-	-	-	-	-	-	89
90-99	-	-	-	78	45	124	5	3	8	-	-	-	-	-	-	-	-	-	132
100-109	-	-	-	64	67	131	13	13	26	-	-	-	-	-	-	-	-	-	157
110-119	-	-	-	87	69	156	44	31	75	-	-	-	-	-	-	-	-	-	231
120-129	-	-	-	70	77	147	70	48	118	-	-	-	-	-	-	-	-	-	265
130-139	-	-	-	86	79	165	106	80	186	1	-	1	-	-	-	-	-	-	352
140-149	-	-	-	39	46	86	124	102	226	-	1	1	-	-	-	-	-	-	313
150-159	-	-	-	39	33	72	115	94	210	-	-	-	-	-	-	-	-	-	282
160-169	-	-	-	27	35	62	104	101	205	-	-	-	-	-	-	-	-	-	267
170-179	-	-	-	25	18	44	72	81	155	1	-	1	-	-	-	-	-	-	200
180-189	-	-	-	27	24	51	44	59	106	1	-	1	-	-	-	-	-	-	158
190-199	-	-	-	10	11	22	37	41	82	-	2	2	-	-	-	-	-	-	106
200-209	-	-	-	6	19	25	22	33	55	-	1	1	-	-	-	-	-	-	81
210-219	-	-	-	4	11	15	17	24	42	-	-	-	-	-	-	-	-	-	57
220-229	-	-	-	1	5	7	14	15	31	1	-	1	-	-	-	-	-	-	39
230-239	-	-	-	3	3	7	12	13	27	2	-	2	-	-	-	-	-	-	36
240-249	-	-	-	-	3	3	9	10	22	2	-	2	-	-	-	-	-	-	27
250-259	-	-	-	-	-	-	4	7	11	-	-	-	-	-	-	-	-	-	11
260-269	-	-	-	1	1	2	3	3	6	-	1	1	-	-	-	-	-	-	9
270-279	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	3
280-289	-	-	-	-	-	-	1	5	7	-	-	-	-	-	-	-	-	-	7
290-299	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300-309	-	-	-	1	-	1	-	1	1	-	-	-	-	-	-	-	-	-	2
310-319	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	-	-	-	2
320-329	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
330-339	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
340-349	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
350-359	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	1
360-369	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
370-379	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
380-389	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
390-399	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	1
400-409	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
410-419	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
420-429	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
430-439	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
440-449	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
450-459	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
460-469	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
470-479	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
480-489	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
490-499	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
500-509	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
510-519	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1
Total	1	-	2	750	711	1,468	822	771	1,612	8	6	14	1	1	2	-	1	1	3,099

APPENDIX TABLE 8.--Weight -frequency distributions in samples of Atlantic menhaden from purse seine catches in the summer fishery, Middle Atlantic Area, 1958

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex																		Total of all age Groups
	1			2			3			4			5			6			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																			
60-69....	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
70-79....	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
80-89....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90-99....	-	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
100-109...	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
110-119...	-	1	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
120-129...	4	-	4	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	5
130-139...	4	1	5	5	4	9	-	-	-	-	-	-	-	-	-	-	-	-	14
140-149...	1	5	6	14	7	21	-	-	-	-	-	-	-	-	-	-	-	-	27
150-159...	5	2	7	28	20	48	-	-	-	-	-	-	-	-	-	-	-	-	55
160-169...	1	1	2	45	31	77	-	-	-	-	-	-	-	-	-	-	-	-	79
170-179...	3	6	9	76	49	125	-	-	-	-	-	-	-	-	-	-	-	-	134
180-189...	5	1	6	97	79	176	1	-	1	-	-	-	-	-	-	-	-	-	183
190-199...	5	2	7	151	109	260	1	2	3	-	-	-	-	-	-	-	-	-	270
200-209...	3	2	5	190	153	346	3	3	6	-	-	-	-	-	-	-	-	-	357
210-219...	4	4	8	195	151	346	6	3	9	-	-	-	-	-	-	-	-	-	363
220-229...	3	-	3	213	189	403	3	2	5	-	-	-	-	-	-	-	-	-	411
230-239...	2	4	6	225	172	397	3	5	8	-	-	-	-	-	-	-	-	-	411
240-249...	1	2	3	197	193	390	4	5	9	-	-	-	-	-	-	-	-	-	402
250-259...	1	2	3	160	203	363	3	3	6	-	-	-	-	-	-	-	-	-	372
260-269...	1	3	4	157	166	323	3	2	5	-	-	-	-	-	-	-	-	-	332
270-279...	1	1	2	153	163	316	3	4	7	-	-	-	-	-	-	-	-	-	325
280-289...	-	-	-	131	154	285	2	11	13	-	-	-	-	-	-	-	-	-	298
290-299...	2	-	2	109	106	215	5	6	11	-	-	-	-	-	-	-	-	-	228
300-309...	-	-	-	94	129	223	4	9	13	-	-	-	-	-	-	-	-	-	236
310-319...	-	-	-	73	110	183	3	3	6	-	-	-	-	-	-	-	-	-	189

APPENDIX TABLE 8.--Weight-frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, Middle Atlantic Area, 1958--Continued

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex																		Total of all age groups
	1			2			3			4			5			6			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																			
320-329...	-	-	-	76	89	165	5	6	11	-	-	-	-	-	-	-	-	-	176
330-339...	-	1	1	65	67	132	2	5	7	-	-	-	-	-	-	-	-	-	140
340-349...	-	-	-	60	60	120	3	3	6	-	-	-	-	-	-	-	-	-	126
350-359...	-	-	-	52	69	121	3	5	8	-	-	-	-	-	-	-	-	-	129
360-369...	-	-	-	46	45	91	4	4	8	-	-	-	-	-	-	-	-	-	99
370-379...	-	-	-	14	43	57	1	3	4	-	1	1	-	-	-	-	-	-	62
380-389...	-	-	-	27	36	63	3	4	7	-	-	-	-	-	-	-	-	-	70
390-399...	-	-	-	11	31	42	-	1	1	-	-	-	-	-	-	-	-	-	43
400-409...	-	-	-	5	22	27	-	3	3	-	-	-	-	-	-	-	-	-	30
410-419...	-	-	-	1	20	21	4	-	4	-	-	-	-	-	-	-	-	-	25
420-429...	-	-	-	3	10	13	1	1	2	-	-	-	-	-	-	-	-	-	15
430-439...	-	-	-	2	7	9	-	2	2	-	-	-	-	-	-	-	-	-	11
440-449...	-	-	-	-	5	5	1	2	3	-	-	-	-	-	-	-	-	-	8
450-459...	-	-	-	-	4	4	4	-	4	1	-	1	-	1	1	-	-	-	10
460-469...	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1
470-479...	-	-	-	-	3	3	-	1	1	-	-	-	-	-	-	-	-	-	4
480-489...	-	-	-	-	-	-	-	4	4	-	-	-	-	-	-	-	-	-	4
490-499...	-	-	-	-	-	-	-	1	1	1	1	2	-	-	-	-	-	-	3
500-509...	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	1
510-519...	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	1
520-529...	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	1
530-539...	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	1
540-549...	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	-	1	2
550-559...	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1
560-569...	-	-	-	-	-	-	1	2	3	-	1	1	-	-	-	-	-	-	4
570-579...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
580-589...	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
590-599...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
600-609...	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
610-619...	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
620-629...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
630-639...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
640-649...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
650-659...	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
660-669...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Total...	51	45	96	2,676	2,701	5,382	76	107	183	6	4	10	-	4	4	1	2	3	5,678

APPENDIX TABLE 9.--Weight frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, North Atlantic Area, 1958

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex																								Total of all age groups
	1			2			3			4			5			6			7			8			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
130-139...	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
140-149...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-159...	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160-169...	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
170-179...	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
180-189...	-	1	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
190-199...	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
200-209...	1	-	1	4	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
210-219...	-	-	-	9	4	13	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
220-229...	-	-	-	10	9	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
230-239...	-	-	-	16	8	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
240-249...	-	-	-	18	13	31	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
250-259...	-	-	-	21	10	31	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
260-269...	-	-	-	32	27	59	3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64
270-279...	-	-	-	46	24	70	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72
280-289...	-	-	-	51	31	82	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87
290-299...	-	-	-	44	30	75	3	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82
300-309...	-	-	-	39	48	87	3	3	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	93
310-319...	-	-	-	41	28	69	3	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76
320-329...	-	-	-	37	38	75	5	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83
330-339...	-	-	-	28	26	54	5	4	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63
340-349...	-	-	-	39	27	66	2	8	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76
350-359...	-	-	-	30	25	55	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60
360-369...	-	-	-	26	21	47	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52
370-379...	-	-	-	27	21	48	5	6	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59
380-389...	-	-	-	11	21	32	6	8	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46
390-399...	-	-	-	11	12	23	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
400-409...	-	-	-	5	9	14	16	5	21	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	36
410-419...	-	-	-	4	16	20	5	4	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
420-429...	-	-	-	3	7	10	10	7	17	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	29
430-439...	-	-	-	3	3	6	9	6	15	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	22
440-449...	-	-	-	-	2	2	7	5	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
450-459...	-	-	-	1	1	2	10	4	14	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	17
460-469...	-	-	-	1	3	4	8	8	16	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	21
470-479...	-	-	-	-	2	2	8	5	13	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	18
480-489...	-	-	-	1	-	1	11	11	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23
490-499...	-	-	-	1	3	4	4	6	10	5	1	6	2	-	2	-	-	-	-	-	-	-	-	-	22
500-509...	-	-	-	-	-	-	11	9	20	1	2	3	1	-	1	-	-	-	-	1	1	-	-	-	25
510-519...	-	-	-	-	-	-	8	10	18	8	1	9	-	-	-	-	-	-	-	-	-	-	-	-	27
520-529...	-	-	-	-	-	-	11	6	17	6	3	9	2	-	2	-	-	-	-	-	-	-	-	-	28
530-539...	-	-	-	-	-	-	10	7	17	7	4	11	3	1	4	-	-	-	-	-	-	-	-	-	32
540-549...	-	-	-	-	-	-	19	3	22	8	-	8	1	3	4	1	-	1	-	-	-	-	-	-	35

APPENDIX TABLE 9.--Weight frequency distributions in samples of Atlantic menhaden from purse-seine catches in the summer fishery, North Atlantic Area, 1958--Continued

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex																							Total of all age groups
	1			2			3			4			5			6			7			8			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
550-559....	-	-	-	-	-	-	17	6	23	7	-	7	2	2	4	3	1	4	-	1	1	-	-	-	39
560-569....	-	-	-	-	-	-	5	12	17	6	7	13	3	-	3	1	-	1	-	-	-	-	-	-	34
570-579....	-	-	-	-	-	-	9	22	31	7	4	11	2	-	2	-	-	-	2	-	2	-	-	-	46
580-589....	-	-	-	-	-	-	8	9	17	11	9	20	2	-	2	1	-	1	1	-	1	-	-	-	41
590-599....	-	-	-	-	-	-	5	10	15	6	6	12	5	-	5	3	1	4	1	-	1	-	-	-	37
600-609....	-	-	-	-	-	-	7	4	11	5	7	12	5	1	6	7	1	8	-	-	-	-	-	-	37
610-619....	-	-	-	-	-	-	3	15	18	3	4	7	7	3	10	4	2	6	1	-	1	-	-	-	42
620-629....	-	-	-	-	-	-	5	7	12	2	10	12	2	3	5	5	2	7	4	1	5	-	-	-	41
630-639....	-	-	-	-	-	-	-	10	10	3	7	10	9	6	15	5	1	6	3	-	3	-	-	-	44
640-649....	-	-	-	-	-	-	-	5	5	3	9	12	4	5	9	2	3	5	2	4	6	-	-	-	37
650-659....	-	-	-	-	-	-	2	7	9	1	3	4	7	2	9	3	4	7	1	1	2	-	-	-	31
660-669....	-	-	-	-	-	-	-	7	7	1	2	3	5	5	10	5	5	10	-	2	2	-	-	-	32
670-679....	-	-	-	-	-	-	-	3	3	2	4	6	2	8	10	3	2	5	-	-	-	-	-	-	25
680-689....	-	-	-	-	-	-	-	2	2	2	2	4	1	4	5	3	3	6	1	-	1	-	-	-	18
690-699....	-	-	-	-	-	-	-	2	2	1	1	2	1	4	5	2	4	6	-	2	2	-	-	-	17
700-709....	-	-	-	-	-	-	-	3	3	-	2	2	4	11	15	-	3	3	1	2	3	-	-	-	26
710-719....	-	-	-	-	-	-	-	-	-	-	1	1	1	12	13	2	5	7	2	2	4	-	-	-	25
720-729....	-	-	-	-	-	-	-	-	-	-	1	1	1	5	6	-	5	5	-	-	-	-	-	-	12
730-739....	-	-	-	-	-	-	-	-	-	-	-	-	-	6	6	-	4	4	-	3	3	-	-	-	13
740-749....	-	-	-	-	-	-	-	-	-	-	2	2	-	4	4	-	1	1	-	3	3	-	-	-	10
750-759....	-	-	-	-	-	-	-	-	-	-	2	2	-	1	1	1	2	3	1	2	3	-	1	1	10
760-769....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2	3	1	3	4	-	-	-	8
770-779....	-	-	-	-	-	-	-	-	-	-	-	-	1	4	5	1	4	5	-	4	4	-	-	-	14
780-789....	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1	2	3	1	-	1	-	-	-	6
790-799....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1	-	1	-	1	1	4
800-809....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	3	3	-	-	-	4
810-819....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	-	3	3	-	-	-	6
820-829....	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	2	2	-	1	1	-	-	-	4
830-839....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
840-849....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	2
850-859....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	2
860-869....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
870-879....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	1	2
880-889....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	2	-	-	-	-	-	-	3
890-899....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
900-909....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
910-919....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
920-929....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
930-939....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2
940-949....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
950-959....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1
Total...	4	1	5	559	474	1,034	253	277	530	102	95	197	75	95	170	54	73	127	23	42	65	1	3	4	2,132

APPENDIX TABLE 10.--Weight frequency distributions in samples from purse-seine catches of Atlantic menhaden, North Carolina fall fishery, 1958

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex																								Total of all age groups
	0			1			2			3			4			5			6			7			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
0-9....	15	4	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
10-19....	33	35	84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84
20-29....	34	31	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82
30-39....	24	17	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52
40-49....	14	14	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31
50-59....	2	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
60-69....	5	3	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
70-79....	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
80-89....	-	-	-	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
90-99....	-	-	-	3	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
100-109...	-	-	-	19	6	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
110-119...	-	-	-	22	10	33	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34
120-129...	-	-	-	25	28	53	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54
130-139...	-	-	-	18	19	37	2	4	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43
140-149...	-	-	-	22	20	42	2	3	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47
150-159...	-	-	-	16	10	26	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
160-169...	-	-	-	5	11	16	2	4	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
170-179...	-	-	-	12	8	20	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23
180-189...	-	-	-	8	8	16	3	2	5	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	22
190-199...	-	-	-	6	6	12	5	4	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
200-209...	-	-	-	4	7	11	5	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
210-219...	-	-	-	2	2	4	6	4	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
220-229...	-	-	-	3	3	6	-	2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	9
230-239...	-	-	-	2	3	5	8	2	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
240-249...	-	-	-	2	1	3	8	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
250-259...	-	-	-	-	2	2	1	4	5	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	8
260-269...	-	-	-	-	2	2	10	4	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
270-279...	-	-	-	1	-	1	11	5	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
280-289...	-	-	-	-	1	1	11	5	16	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	18
290-299...	-	-	-	2	-	2	19	5	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26
300-309...	-	-	-	1	-	1	19	5	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25
310-319...	-	-	-	1	-	1	20	16	36	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	38
320-329...	-	-	-	-	2	2	18	13	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
330-339...	-	-	-	-	-	-	26	14	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
340-349...	-	-	-	-	1	1	17	11	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29
350-359...	-	-	-	2	1	3	13	19	32	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	37
360-369...	-	-	-	-	1	1	19	22	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
370-379...	-	-	-	-	1	1	23	21	44	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	47
380-389...	-	-	-	-	-	-	23	17	40	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	42
390-399...	-	-	-	-	-	-	19	10	29	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	30
400-409...	-	-	-	-	-	-	23	19	42	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	44
410-419...	-	-	-	-	-	-	25	23	48	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	52
420-429...	-	-	-	-	-	-	27	13	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
430-439...	-	-	-	-	-	-	18	23	41	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	43
440-449...	-	-	-	-	-	-	6	17	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23
450-459...	-	-	-	-	-	-	8	15	23	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	27
460-469...	-	-	-	-	-	-	8	12	20	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	22
470-479...	-	-	-	-	-	-	3	4	7	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-	10
480-489...	-	-	-	-	-	-	5	5	10	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	14

APPENDIX TABLE 10.--Weight frequency distributions in samples from purse-seine catches of Atlantic menhaden, North Carolina fall fishery, 1958--Continued

[M = male, F = female, T = total, including specimens for which sex was not determined.]

Weight	Number of fish by age group and sex																								Total of all age groups
	0			1			2			3			4			5			6			7			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
G.																									
490-499....	-	-	-	-	-	-	1	3	4	2	2	4	1	1	2	-	-	-	-	-	-	-	-	-	10
500-509....	-	-	-	-	-	-	1	4	5	4	3	7	-	-	-	-	-	-	-	-	-	-	-	-	12
510-519....	-	-	-	-	-	-	-	1	1	2	4	6	-	-	-	-	-	-	-	-	-	-	-	-	7
520-529....	-	-	-	-	-	-	-	1	1	2	2	4	-	-	-	-	-	-	-	-	-	-	-	-	5
530-539....	-	-	-	-	-	-	-	2	2	3	2	5	2	-	2	-	-	-	-	-	-	-	-	-	9
540-549....	-	-	-	-	-	-	-	-	-	6	4	10	-	-	-	1	-	1	-	-	-	-	-	-	11
550-559....	-	-	-	-	-	-	-	1	1	4	3	7	2	-	2	-	-	-	-	-	-	-	-	-	10
560-569....	-	-	-	-	-	-	-	2	2	2	3	5	2	-	2	-	-	-	-	-	-	-	-	-	9
570-579....	-	-	-	-	-	-	-	-	-	3	3	6	1	-	1	2	-	2	-	-	-	-	-	-	9
580-589....	-	-	-	-	-	-	-	-	-	4	3	7	-	1	1	-	-	-	-	-	-	-	-	-	8
590-599....	-	-	-	-	-	-	-	-	-	1	4	5	-	-	-	-	-	-	-	-	-	-	-	-	5
600-609....	-	-	-	-	-	-	-	-	-	7	4	11	5	2	7	-	-	-	1	-	1	-	1	1	20
610-619....	-	-	-	-	-	-	-	-	-	7	3	10	1	-	1	3	1	4	-	-	-	-	-	-	15
620-629....	-	-	-	-	-	-	-	-	-	5	2	7	4	1	5	4	-	4	-	-	-	-	-	-	16
630-639....	-	-	-	-	-	-	-	-	-	4	3	7	1	-	1	2	1	3	2	-	2	-	-	-	13
640-649....	-	-	-	-	-	-	-	-	-	2	2	4	3	1	4	1	2	3	1	-	1	-	-	-	12
650-659....	-	-	-	-	-	-	-	-	-	3	7	10	2	1	3	1	1	2	2	2	4	-	1	1	20
660-669....	-	-	-	-	-	-	-	-	-	1	5	6	3	2	5	3	1	4	1	-	1	1	-	1	17
670-679....	-	-	-	-	-	-	-	-	-	2	4	6	-	4	4	2	-	2	2	-	2	1	-	1	15
680-689....	-	-	-	-	-	-	-	-	-	-	4	4	2	2	4	2	1	3	-	-	-	-	-	-	11
690-699....	-	-	-	-	-	-	-	-	-	1	5	6	3	1	4	3	-	3	1	-	1	-	-	-	14
700-709....	-	-	-	-	-	-	-	-	-	-	6	6	1	4	5	2	6	8	1	-	1	-	-	-	20
710-719....	-	-	-	-	-	-	-	-	-	-	2	2	-	2	2	-	4	4	-	-	-	1	1	2	10
720-729....	-	-	-	-	-	-	-	-	-	-	3	3	1	1	2	2	2	4	1	3	4	1	2	3	16
730-739....	-	-	-	-	-	-	-	-	-	-	2	2	-	1	1	-	3	3	-	2	2	2	-	2	10
740-749....	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	-	5	5	2	2	4	1	1	2	13
750-759....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2	3	2	1	3	-	-	-	7
760-769....	-	-	-	-	-	-	-	-	-	-	2	2	-	1	1	-	4	4	-	1	1	-	6	6	14
770-779....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	3	3	-	5	5	-	1	1	10
780-789....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-	1	1	-	-	-	4
790-799....	-	-	-	-	-	-	-	-	-	1	-	1	-	1	1	-	7	7	-	2	2	-	1	1	12
800-809....	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	-	3	3	-	2	2	-	-	-	9
810-819....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	2
820-829....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	1	1	-	2	2	5
830-839....	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	5	5	1	-	1	-	-	-	7
840-849....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	1	2
850-859....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	2
860-869....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	2
870-879....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
880-889....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	-	2
890-899....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
900-909....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
910-919....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
920-929....	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1
Total	128	108	284	179	158	338	419	345	764	84	102	186	35	35	70	29	59	88	17	26	43	7	20	27	1,800

APPENDIX TABLE 11.--Mean fork length and weight in samples from purse seine catches of Atlantic menhaden in the summer fishery, South Atlantic Area, 1958

[Numbers of fish in parentheses.]

Age group	Sex					
	Males		Females		Both sexes	
	Fork Length (mm)					
0	132.0	(2)	-	-	132.0	(2)
1	165.7	(729)	169.4	(646)	167.4	(1375)
2	189.2	(309)	191.4	(281)	190.2	(590)
3	200.6	(22)	202.8	(17)	201.6	(39)
4	211.0	(1)	-	-	211.0	(1)
	Weight (g)					
0	40.0	(2)	-	-	40.0	(2)
1	80.9	(729)	87.7	(646)	84.1	(1375)
2	117.9	(309)	122.4	(281)	120.0	(590)
3	137.4	(22)	149.5	(17)	142.7	(39)
4	157.0	(1)	-	-	157.0	(1)

APPENDIX TABLE 12.--Mean fork length and weight in samples from purse seine catches of Atlantic menhaden in the summer fishery, Chesapeake Bay Area, 1958

[Numbers of fish in parentheses.]

Age group	Sex					
	Males		Females		Both sexes	
	Fork Length (mm)					
0	118.0	(1)	-	-	118.0	(1)
1	188.0	(750)	190.5	(711)	189.2	(1461)
2	211.4	(822)	214.5	(771)	212.9	(1593)
3	234.9	(8)	243.3	(6)	238.5	(14)
4	317.0	(1)	297.0	(1)	307.0	(2)
5	-	-	311.0	(1)	311.0	(1)
	Weight (g)					
0	28.0	(1)	-	-	28.0	(1)
1	116.7	(750)	121.8	(711)	119.2	(1461)
2	158.1	(322)	165.2	(771)	161.6	(1593)
3	209.2	(8)	220.5	(6)	214.1	(14)
4	510.0	(1)	428.0	(1)	469.0	(2)
5	-	-	480.0	(1)	480.0	(1)

APPENDIX TABLE 13.--Mean fork length and weight in samples from purse seine catches of Atlantic menhaden in the summer fishery, Middle Atlantic Area, 1958

[Numbers of fish in parentheses.]

Age group	Sex					
	Males		Females		Both sexes	
	Fork Length (mm)					
1	213.7	(51)	214.3	(45)	214.0	(96)
2	236.9	(2676)	240.7	(2702)	238.8	(5378)
3	250.9	(76)	254.6	(107)	253.0	(183)
4	298.2	(6)	302.5	(4)	299.9	(10)
5	-	-	313.5	(4)	313.0	(4)
6	318.0	(1)	325.5	(2)	323.0	(3)
	Weight (g)					
1	180.8	(51)	184.5	(45)	182.6	(96)
2	252.8	(2676)	267.4	(2701)	260.1	(5377)
3	309.0	(76)	326.2	(107)	319.1	(183)
4	503.7	(6)	510.8	(4)	506.5	(10)
5	-	-	577.8	(4)	577.8	(4)
6	543.0	(1)	654.5	(2)	617.3	(3)

APPENDIX TABLE 14.--Mean fork length and weight in samples from purse seine catches of Atlantic menhaden in the summer fishery, Middle Atlantic Area, 1958

[Numbers of fish in parentheses.]

Age group	Sex					
	Males		Females		Both sexes	
	Fork Length (mm)					
1	224.0	(4)	220.0	(1)	223.2	(5)
2	253.4	(559)	256.2	(474)	254.7	(1033)
3	289.8	(253)	295.0	(277)	292.5	(530)
4	306.3	(102)	314.3	(95)	310.2	(197)
5	316.2	(75)	325.3	(95)	321.3	(170)
6	321.4	(54)	333.4	(73)	328.3	(127)
7	324.5	(23)	333.6	(42)	330.4	(65)
8	354.0	(1)	340.7	(3)	344.0	(4)
	Weight (g)					
1	180.0	(4)	183.0	(1)	180.6	(5)
2	310.7	(559)	323.6	(474)	316.6	(1033)
3	478.3	(253)	507.1	(277)	493.4	(530)
4	564.1	(102)	613.5	(95)	587.9	(197)
5	621.7	(75)	692.4	(95)	661.2	(170)
6	642.7	(54)	729.8	(73)	692.7	(127)
7	661.5	(23)	737.6	(42)	710.6	(65)
8	889.0	(1)	811.3	(3)	833.2	(4)

APPENDIX TABLE 15.--Mean fork length and weight in samples from purse seine catches of Atlantic menhaden, North Carolina fall fishery, 1958

[Numbers of fish in parentheses.]

Age group	Sex					
	Males		Females		Both sexes	
	Fork Length (mm)					
0	115.2	(128)	117.0	(109)	116.0	(237)
1	199.1	(179)	204.6	(158)	201.7	(337)
2	262.2	(423)	266.4	(345)	264.1	(768)
3	299.7	(84)	306.7	(102)	303.6	(186)
4	310.4	(37)	319.6	(35)	314.9	(72)
5	317.4	(29)	326.7	(59)	323.6	(88)
6	321.0	(17)	332.1	(26)	327.7	(43)
7	323.6	(7)	331.8	(20)	329.7	(27)
	Weight (g)					
0	26.4	(128)	26.6	(108)	26.5	(236)
1	149.6	(179)	160.7	(158)	154.8	(337)
2	350.1	(419)	371.5	(345)	359.8	(764)
3	548.8	(84)	593.3	(102)	573.2	(186)
4	629.2	(35)	706.3	(35)	667.8	(70)
5	654.7	(29)	755.4	(59)	722.2	(88)
6	693.7	(17)	771.3	(26)	740.6	(43)
7	714.7	(7)	770.2	(20)	755.6	(27)

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